VOLUME XLIV NUMBER ONE

THE NATIONAL GEOGRAPHIC MAGAZINE

JULY, 1923

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TO carry out the purposes for which it was founded thirty-four years ago, the National Geographic Society publishes this Magazine. All receipts are invested in the Magazine itself or expended directly to promote geographic knowledge.

ARTICLES and photographs are desired. For material which the Magazine can use, generous remuneration is made. Contributions should be accompanied by an addressed return envelope and postage.

IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resultant given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

AT an expense of over $50,000 The Society sent a notable series of expeditions into Peru to investigate the traces of the Inca race. Their discoveries form a large share of our knowledge of a civilization which was waning when Pizarro first set foot in Peru.

THE Society also had the honor of subscribing a substantial sum to the historic expedition of Admiral Peary, who discovered the North Pole.

NOT long ago The Society granted $25,000, and in addition $75,000 was given by individual members through The Society to the Federal Government when the congressional appropriation for the purchase was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people and incorporated into a National Park.

THE Society is conducting extensive explorations and excavations in northwestern New Mexico, which was one of the most densely populated areas in North America before Columbus came, a region where prehistoric peoples lived in vast communal dwellings whose ruins are ranked second to none of ancient times in point of architecture, and whose customs, ceremonies and name have been engulfed in an oblivion more complete than any other people who left traces comparable to theirs.

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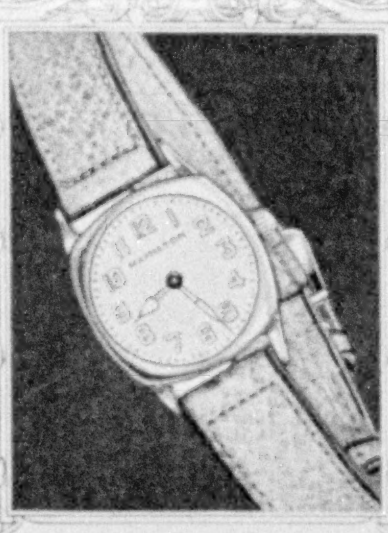
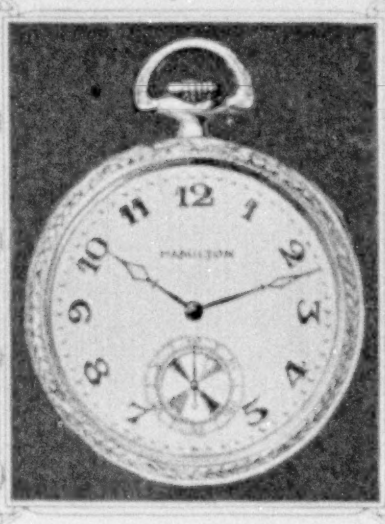


Man's Strap Watch
Sterling $50, 14k Green Gold $75
Leather strap and luminous dial



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14k green or white gold, engraved.
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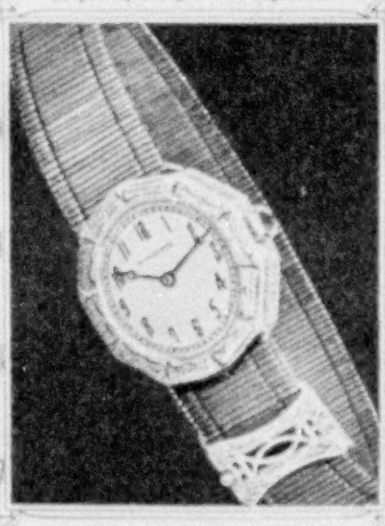

White Gold Filled $48
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In four shapes, plain or engraved.

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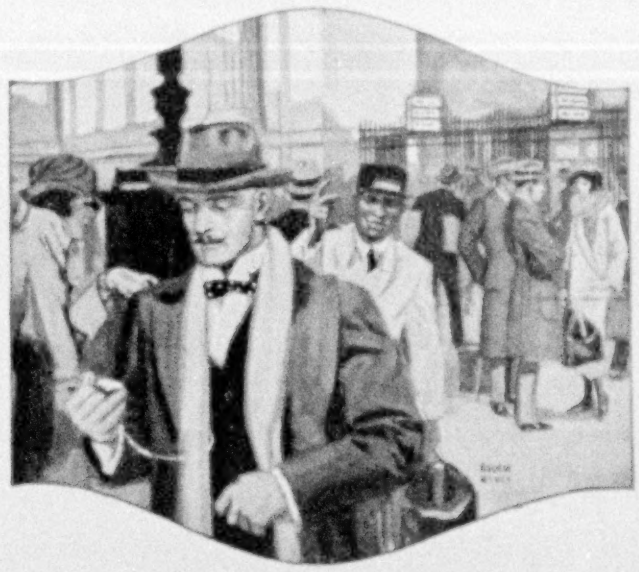

Should *you* own a Hamilton?

That depends!

You should, this minute, if accuracy is a thing you respect, and your taste a thing you want others to respect.

Accuracy is built into all Hamiltons; which means that they are first of all accurate timekeepers.

Beauty in a Hamilton is an outward expression of intrinsic quality. You know the one is worthy of the other.

The Hamilton has won the reputation of "The Watch of Railroad Accuracy" by being worthy of it.

Send for copy of our new "Timekeeper"

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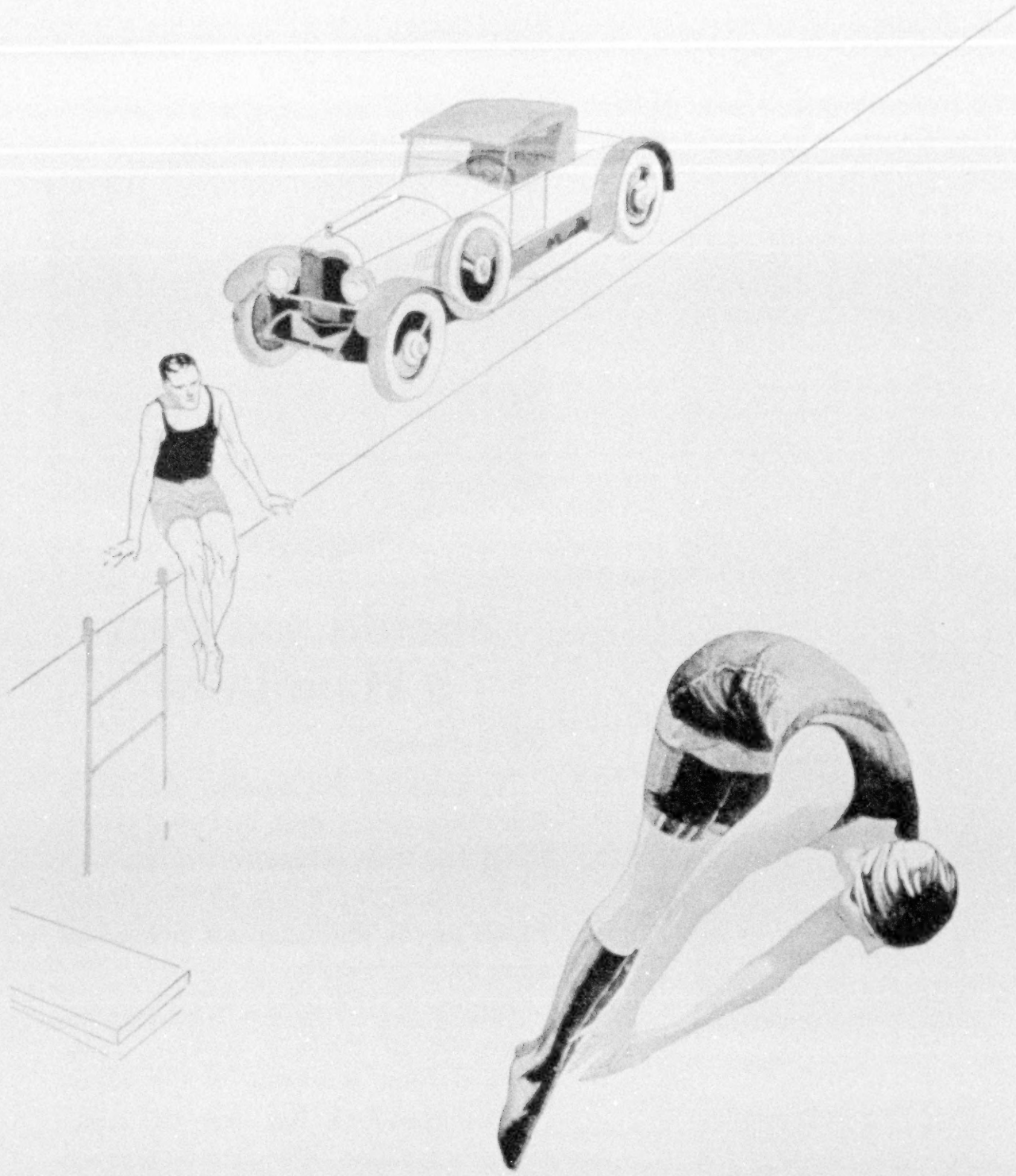
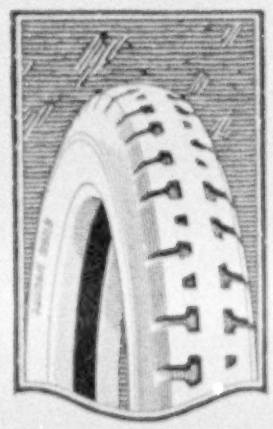
The Watch of Railroad Accuracy



MASON CORDS

THOSE, whose keen appreciation is as unfailing as youth, find in Mason Cords that rare dependability of the thoroughbred. More and more the conviction grows that for *true value* these proficient tires are the sensible buy. And so one sees them in ever increasing numbers on the finest cars in the land.



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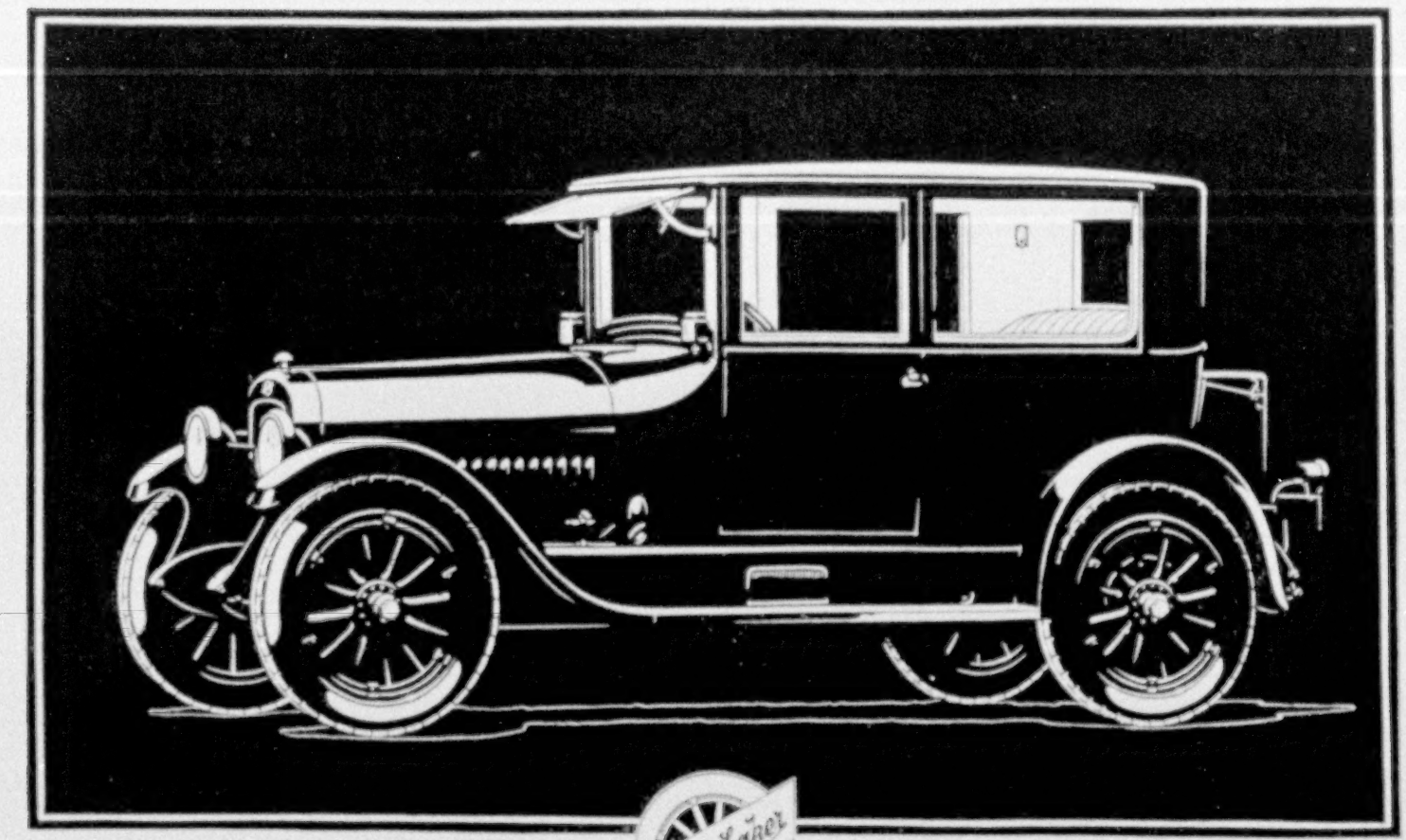

THE new Studebaker Special-Six five-passenger Coupe ideally combines the seating capacity of the Sedan, the sociability of the Coupe and a famous chassis.

Like all Studebaker enclosed cars its body construction is of the permanent type and, avoiding freaks and frills of design, will remain in good style and endure for years.

It is built in Studebaker plants where fine coach-building has been in progress for more than two generations. Into it are incorporated Studebaker's traditional standards of quality and value.

The well arranged interior accommodates five in genuine comfort. The individual front seats are identical in design and cushioning. The wide rear seat, deeply upholstered and placed at the most restful angle, provides generous room for three. Upholstery is of highest grade mohair velvet plush of soft, neutral tone.

The five-passenger Coupe is elegantly fitted with every provision for your comfort and convenience including a commodious trunk; one-piece, rain-proof windshield with glare-proof, glass visor; automatic windshield cleaner and rear-view mirror; heater; clock; flower vase; running board step pads and aluminum kick plates; coach lamps, rear corner reading lamps, courtesy light and many other refinements.

Mounted upon the Studebaker Special-Six chassis which is notable for its long life, dependable performance and freedom from repairs, the satisfaction of the Coupe is assured.

MODELS AND PRICES—*f. o. b. U.S. factories*

LIGHT-SIX *5-Pass., 112" W. B., 40 H. P.*		SPECIAL-SIX *5-Pass., 119" W. B., 50 H. P.*		BIG-SIX *7-Pass., 126" W. B., 60 H. P.*	
Touring	$ 975	Touring	$1275	Touring	$1750
Roadster (3-Pass.)	975	Roadster (2-Pass.)	1250	Speedster (5-Pass.)	1835
Coupe-Road. (2-Pass.)	1225	Coupe (5-Pass.)	1975	Coupe (5-Pass.)	2550
Sedan	1550	Sedan	2050	Sedan	2750

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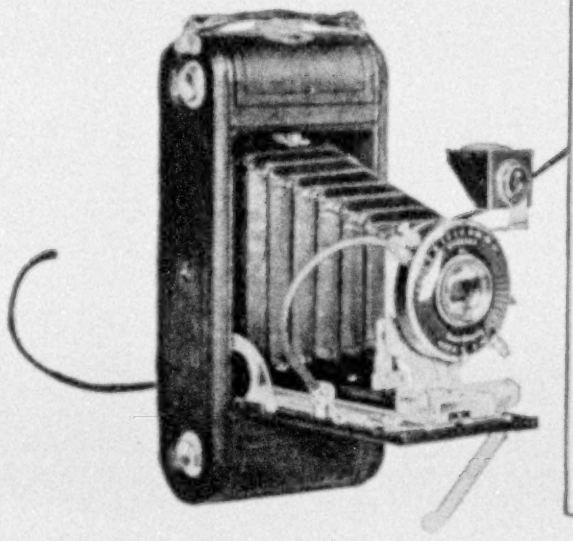
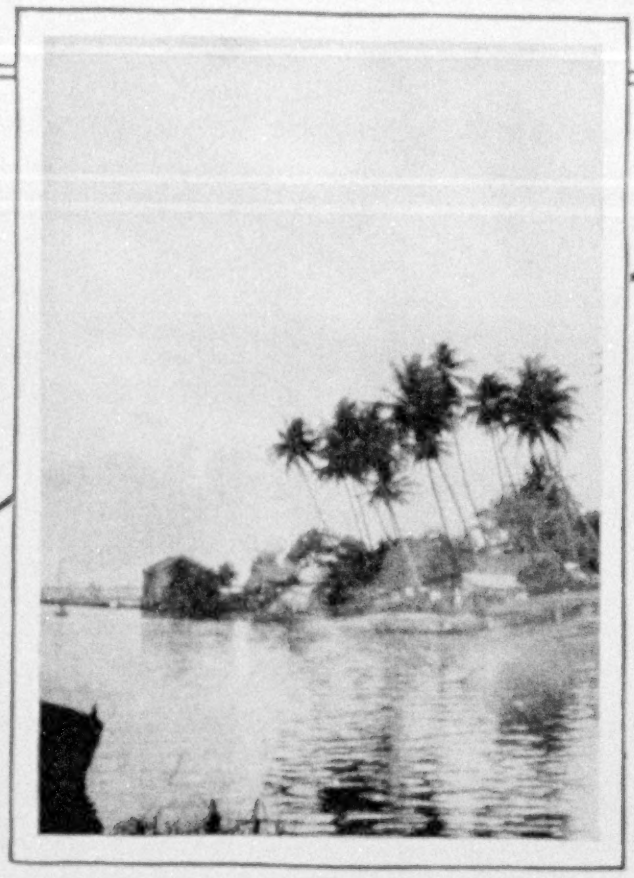
No. 1 A Ansco Speedex

Ansco F 6.3 Anastigmat Lens, 4¼ inch focus; Optimo or Ilex Acme Shutter, 2½ x 4¼, 6 A Film. Price $45.00. Others this size $17.00 and $27.50.





They always turn out better with the No. 1 A Ansco Speedex

THE unusual adaptability of the No. 1A Ansco Speedex has made it a favorite with travelers. An extra fast shutter (up to 1/300 second), and an F 6.3 lens, permit fast exposures of rapid motion in good light, as well as snapshots under unfavorable conditions.

The No. 1A Ansco Speedex is an aristocrat in appearance. Covered with genuine Persian morocco leather, slim and graceful, yet very strongly built, it appeals particularly to those who appreciate fine things.

Be sure to see this truly wonderful camera before going on your next trip. Note the many exclusive features which make it really difficult to get poor pictures.

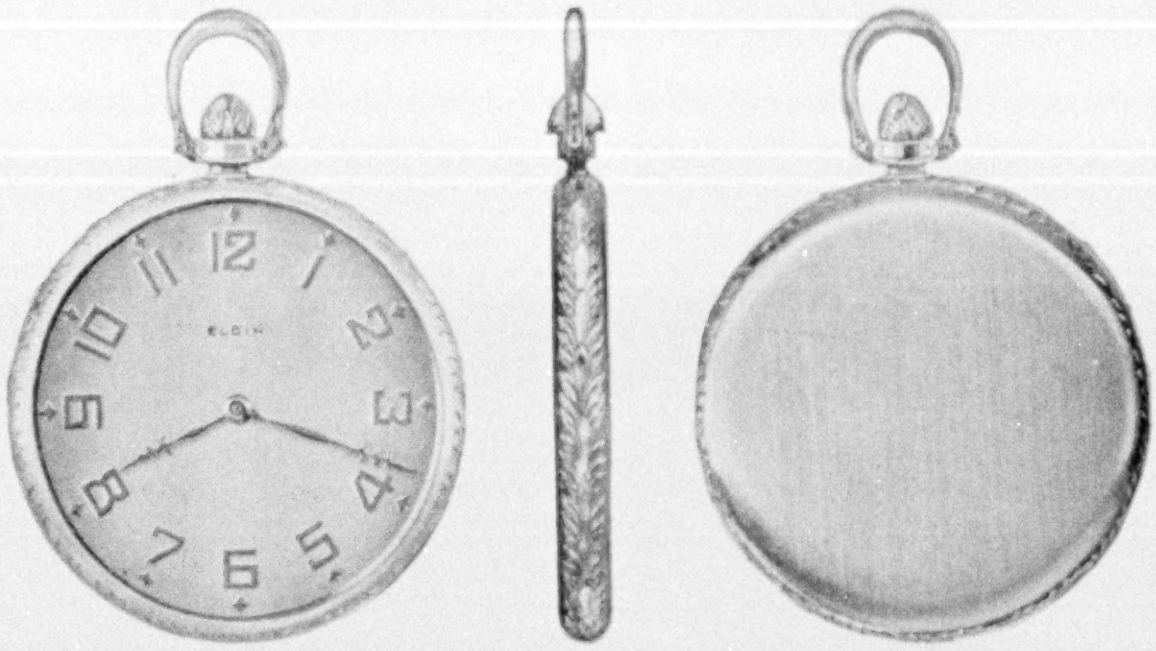
—and remember Ansco Speedex Film

In any make of camera its wider range of exposure makes it "fit the light, dull or bright." In combination with an Ansco camera it insures the largest possible percentage of fine results. Look for the red box with the yellow band.

ANSCO COMPANY, BINGHAMTON, N. Y.

CAMERAS ANSCO FILM

The red box with the yellow band. Fits any make of camera.



The "Presentation" Elgin—ultra-thin and the finest watch ever presented to the men of America. Hand-made case of either 14-karat or 18-karat gold, engraved. $300 to $500.

America's Change of Thought on Watches

THE buying power of America makes it a coveted market for watches.

This country has had a chance to try nearly *all* the different grades of watches in the world—both foreign and domestic.

Watches are bought so infrequently that it took a long time for watch-users to become watch-wise as a nation.

But today human experience *is breaking through.*

* * *

People are finding out that what they chose a watch *for* in the past wasn't what they really wanted at all.

They are finding out that nothing is more *extravagant* than the cheap watch.

Nor, on the other hand, nothing more impractical than the watch which sells on an outward *jewelry* value instead of time-keeping good faith.

Today's insistence on *better timekeepers* turns naturally to the *professional time-piece.*

The *professional* Elgin with its almost unbelievable goodwill.

With its place of affection and recognition, wherever you find Americans who refuse to carry anything but a watch of *timekeeping responsibility.*

There is a shortage of Elgin Watches.

There has been for the past two years.

Wherever you find an Elgin that suits your idea of beauty and price, by all means *take it at once.*

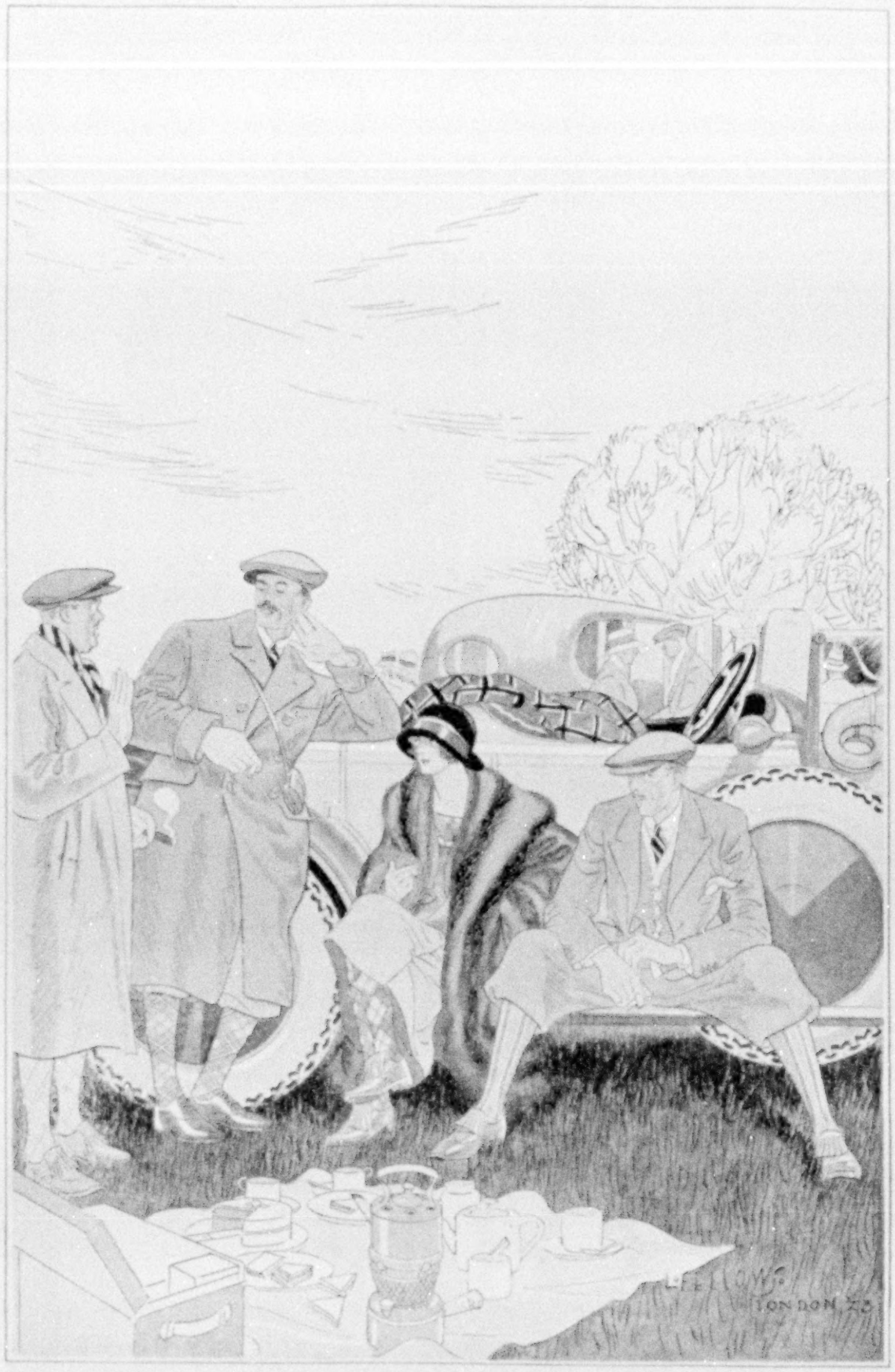
ELGIN NATIONAL WATCH COMPANY, ELGIN, U. S. A.

ELGIN

The Professional Timekeeper

IT takes a year or more to make an Elgin Watch. The procedure is very similar to laboratory work—so far away from factory methods that no terms of commercial manufacture apply.

People call the Elgin "The professionaltime-keeper." It is the natural reaction of carrying a time-piece of *authority. Elgin is the preferred time-piece on the Railroads of America.*



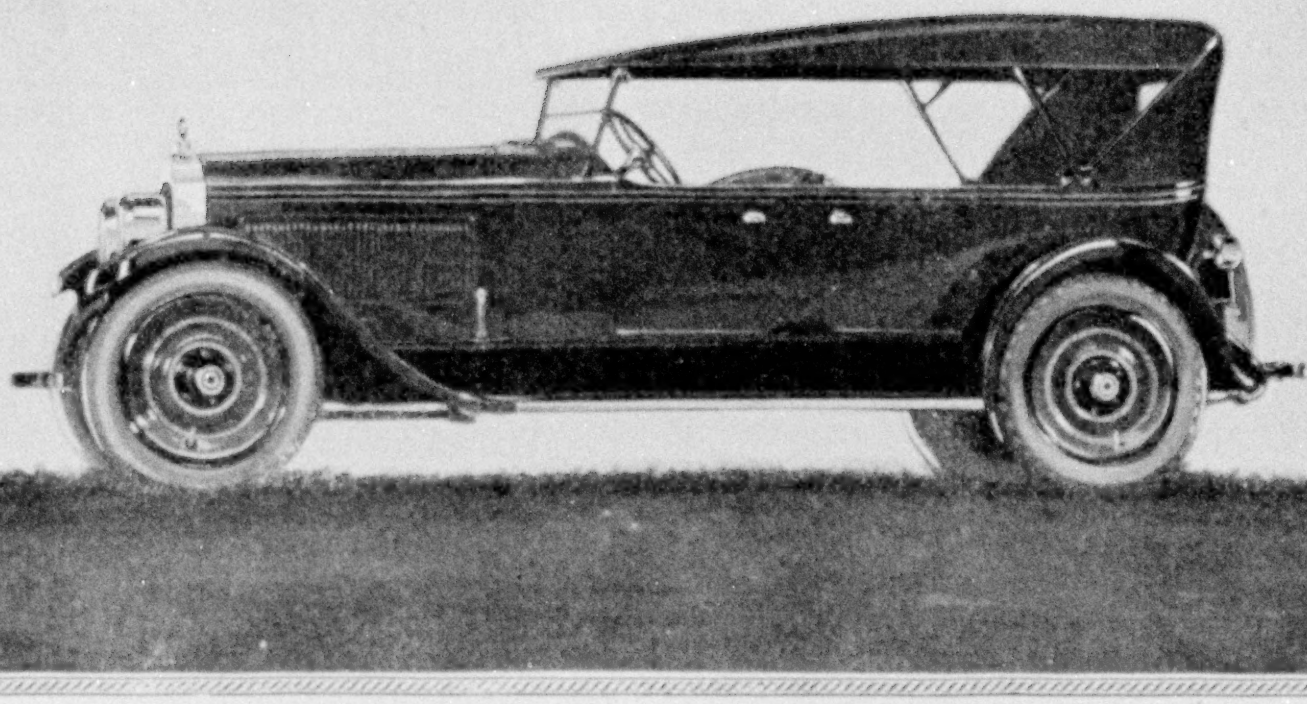
"Rotten roads? I should say they WERE rotten! And slippery—! We nearly skidded into the ditch twice."
"You ought to use Kelly Cords, old man. They'd save you a lot of worry."

THERE is scarcely a car owner who has not heard motorist friends praise Kelly Cords. Yet it is hard for a man to realize, until he has learned from experience, that any tire can be so surefooted on all kinds of roads and in all kinds of weather as the Kelly Cord is; or that any tire can give such long mileage under all conditions as the Kelly Cord does. It costs *no more* to buy a Kelly.

SINGLE-EIGHT

A New Production by

PACKARD



The Packard Motor Car Company presents the Packard Single-Eight, embodying principles and results hitherto unknown.

Companion to the Single-Six—successor to the Twin-Six, the Single-Eight demonstrates an ample margin of superiority in performance over any possible claimant for comparison, American or Continental.

Packard Single-Eight is a rational and logical development, contributing, we believe, a new page to the annals of motor car engineering.

It is unique in that it does away forever with the idea that complexity and high maintenance cost are the penalties for attaining the utmost in fleetness, acceleration, flexibility and motoring luxury.

Here is a car with such an abundance of power as to dwarf the ability of any other in the world, so easily controlled that it will respond to the lightest touch, so brilliant in appearance that its beauty is dominant in any company.

The Packard Motor Car Company invites you to enjoy behind the wheel of the Single-Eight, an experience which no words of ours can adequately portray in advance.

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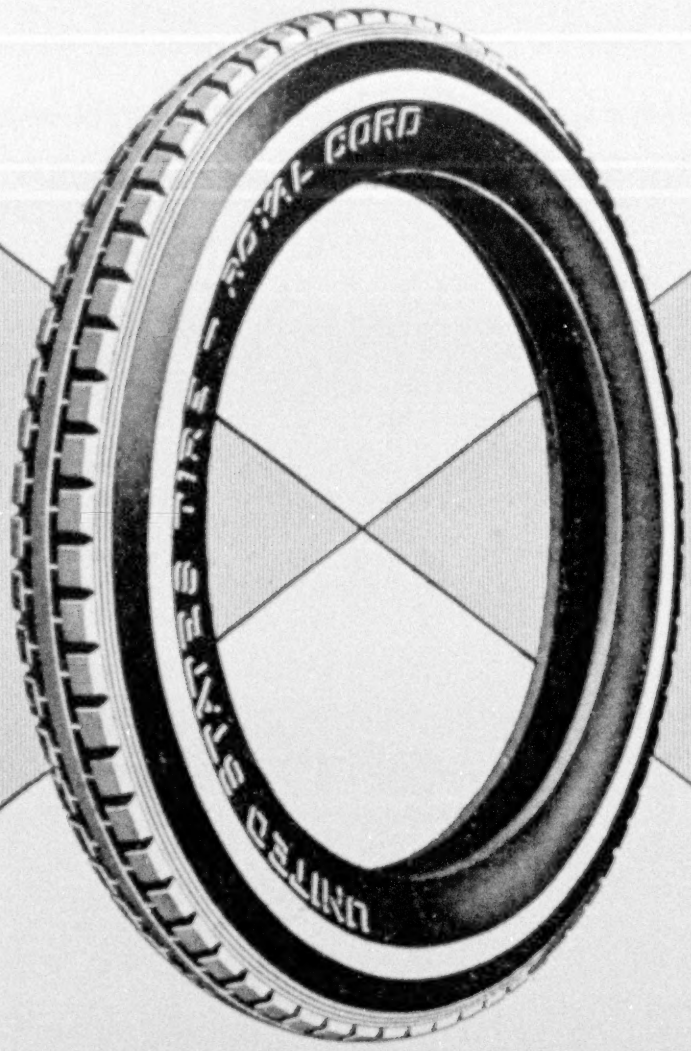

One million new users will say this year: "Royal Cords!"

The New Discoveries in Rubber Manufacture
Now applied to U.S. Royal Cords

BY this time you have probably read the newspaper announcements of the three greatest discoveries in tire manufacture in the history of tires.

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1. Sprayed Rubber—the first truly *pure* rubber.
2. Web Cord—a rubber-webbed sheet of cords with every filament of each cord impregnated and surrounded by pure natural rubber. It does away with all cross tie-threads. It is the most substantial step in friction elimination since the old type square woven fabric gave way to cord construction.
3. The new Flat Band Process of building a cord tire—ensuring for the first time a uniform tire equalized through and through in resiliency and resistance to puncture and wear.

These three new major contributions to the art of rubber manufacture have been utilized to give the Royal Cord a better, longer lived—more resilient carcass and a better, stronger, longer wearing tread.

Again you see U. S. Royal Cords living up to their leadership obligations.

Again you see U. S. Royal Cords practicing what they preach:

Competition for greater public *confidence* and larger public *service*.

Trade Mark

United States Tires
are Good Tires

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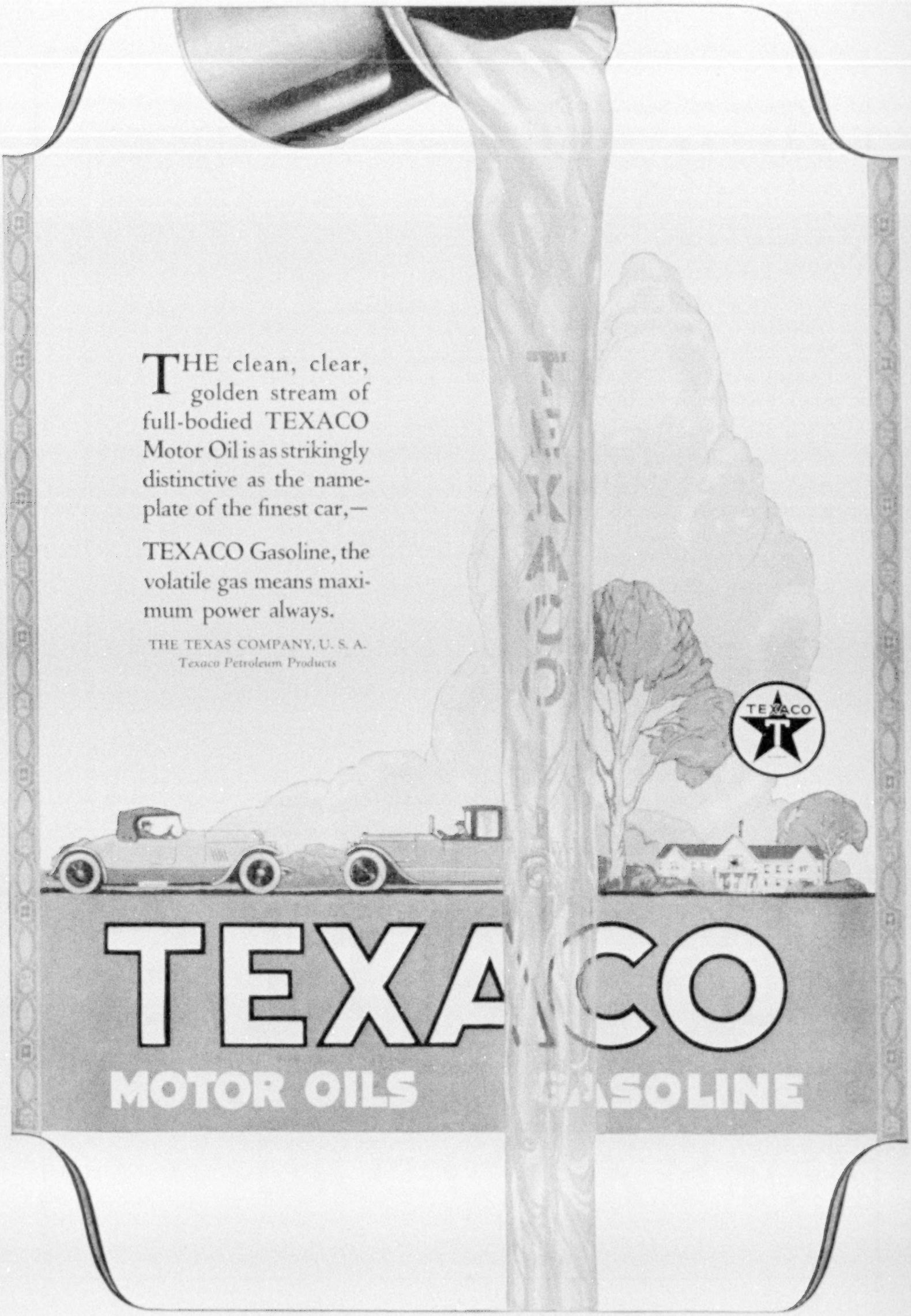
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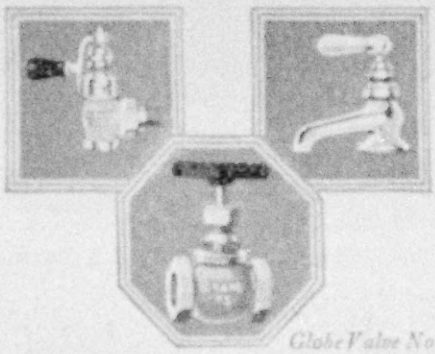
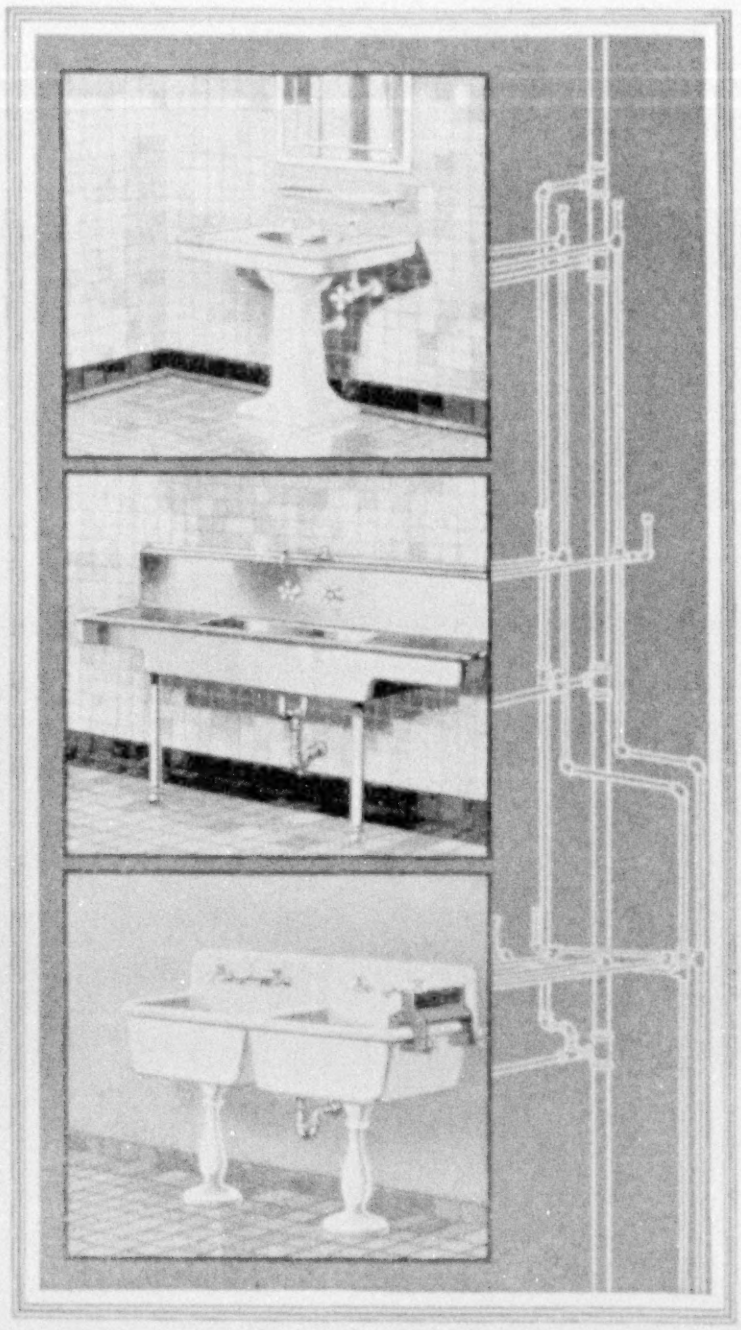


Globe Valve No. 1-R



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EXTRA LARGE AND EXTRA SAFE

In the construction of Dodge Brothers Motor Car, every consideration has been given to the owner's safety.

This is particularly evident in the brakes, which, with their 14-inch drums and 2¼ inch lining, are appreciably larger than the average. The extra surface thus provided develops greater friction when the brake bands contract over the drums—and it is this friction which stops the car.

Connecting levers are designed to transmit the maximum of power with the minimum of effort. The slightest pressure on the brake pedal has an immediate effect. This pressure is distributed evenly between the two rear wheels by a highly efficient equalizer, which prevents skidding because it retards both wheels simultaneously.

And the brake bands grip evenly all around the drums. This protects the lining against irregular wear and enables the driver to stop quickly, quietly and safely.

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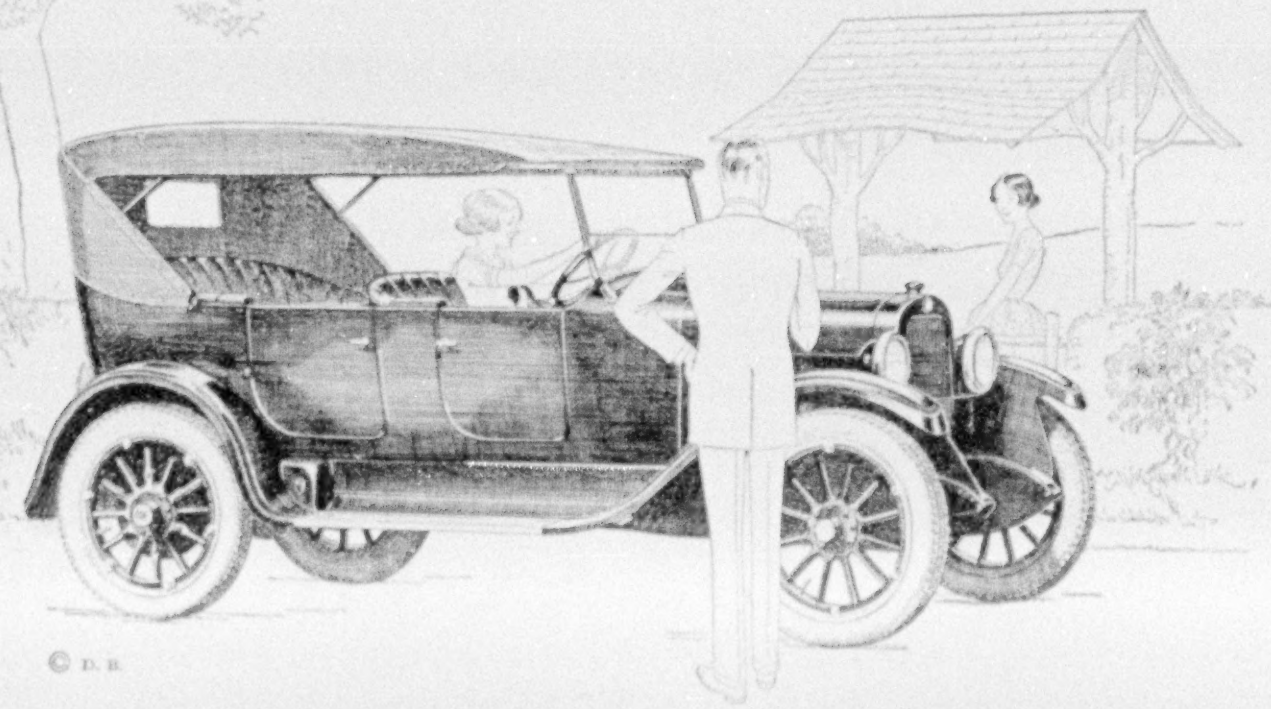
The price of the Touring Car is $880 f. o. b. Detroit



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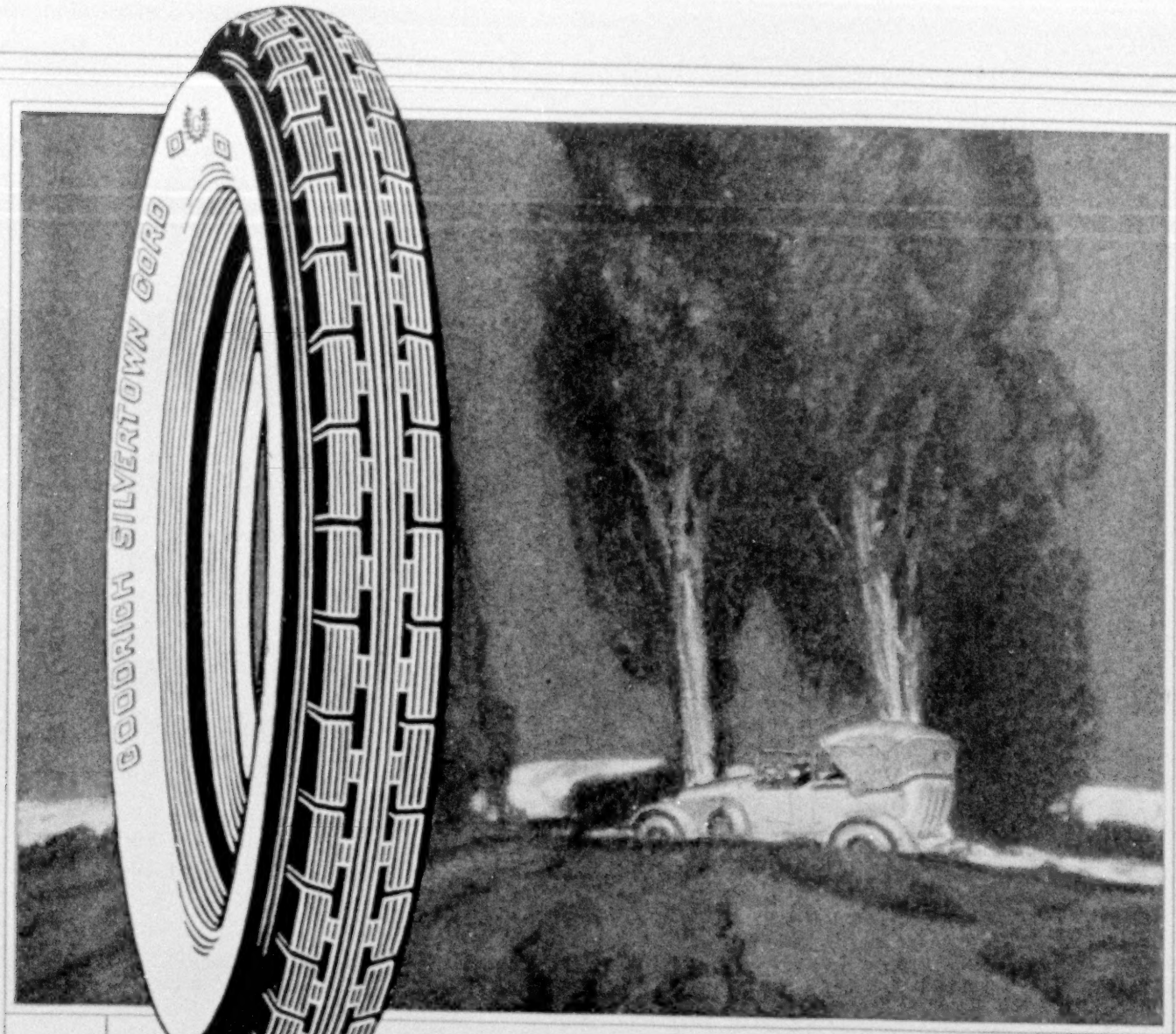

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Your right to full value in the tire you buy is protected by the one-quality policy back of the Goodrich Silvertown Cord. This protection is increased by the exacting standards to which the Silvertown is built. You are further protected by the Goodrich Dealer, a merchant you can rely on, whose service is on a plane with the tire he makes his leader—the Goodrich Silvertown Cord.

THE B. F. GOODRICH RUBBER COMPANY, Established 1870

In Canada—The B. F. Goodrich Rubber Company, Ltd.

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GOODRICH
SILVERTOWN CORD

SOLD BY GOODRICH DEALERS THE WORLD OVER

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IF you are going to the Orient, you can now go, at surprisingly small cost, over a route mellowed by sunshine, cooled by soft breezes, on swift luxurious ships that make every day of the voyage a new delight—a perfect preparation for your holiday amid the wonders of the Orient.

Send the information blank below today and learn about the magnificent United States Government ships, operated by the Pacific Mail Steamship Company from San Francisco over its famous "Sunshine Belt to the Orient." Eastern Ports of call are Yokohama, Kobe, Shanghai, Hong Kong and Manila. Stop overs may be arranged in any of these ports.

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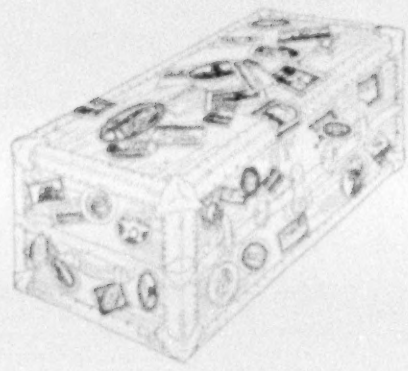

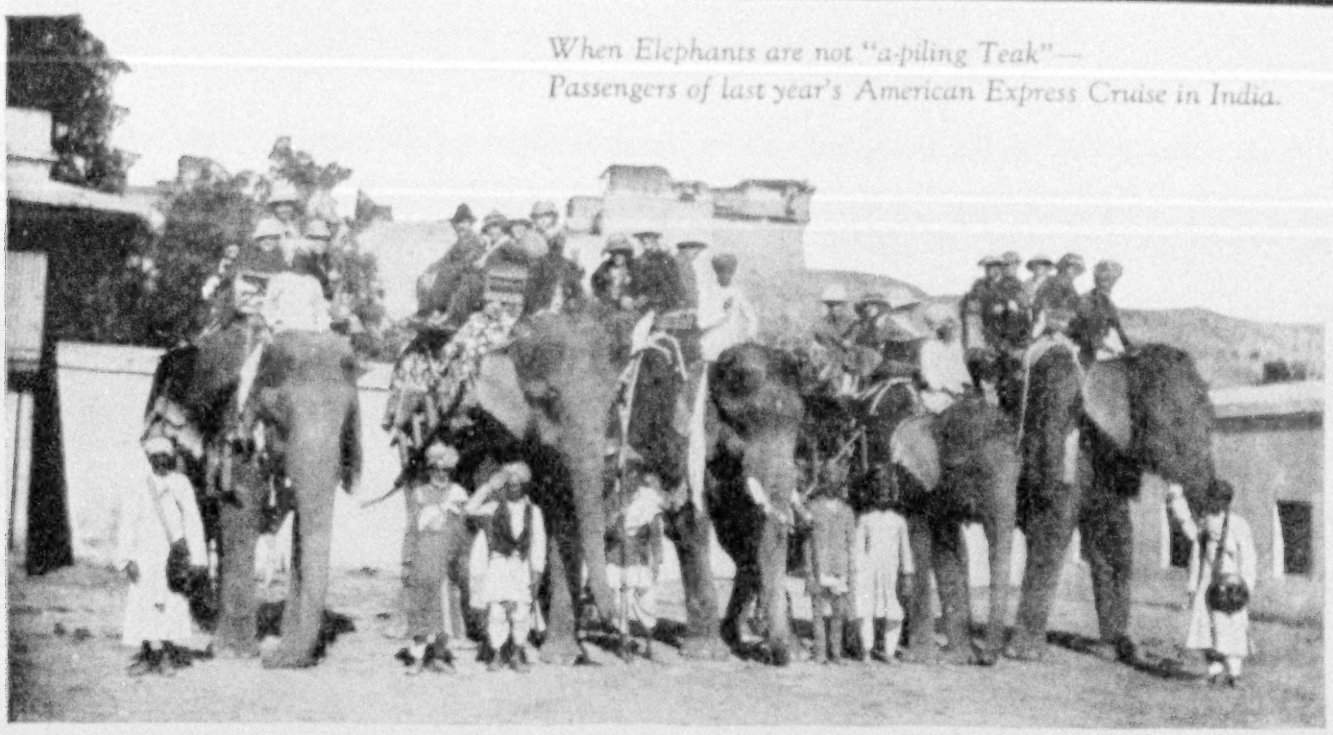

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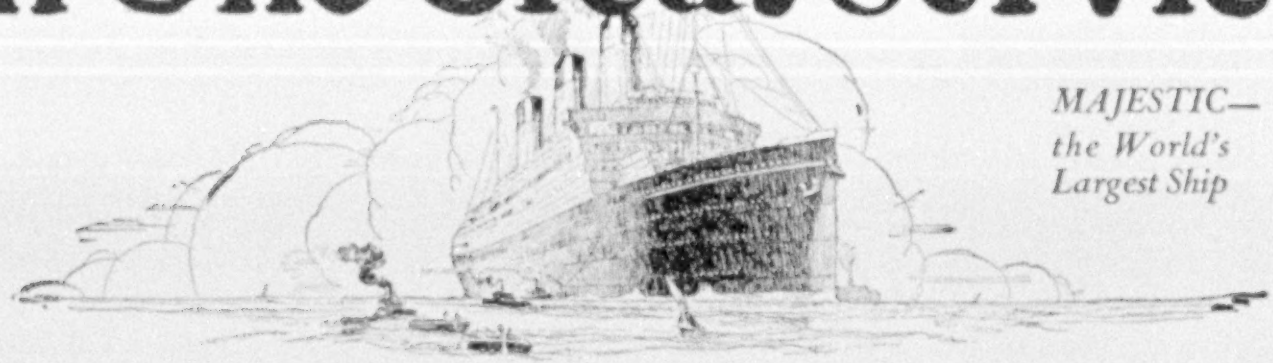

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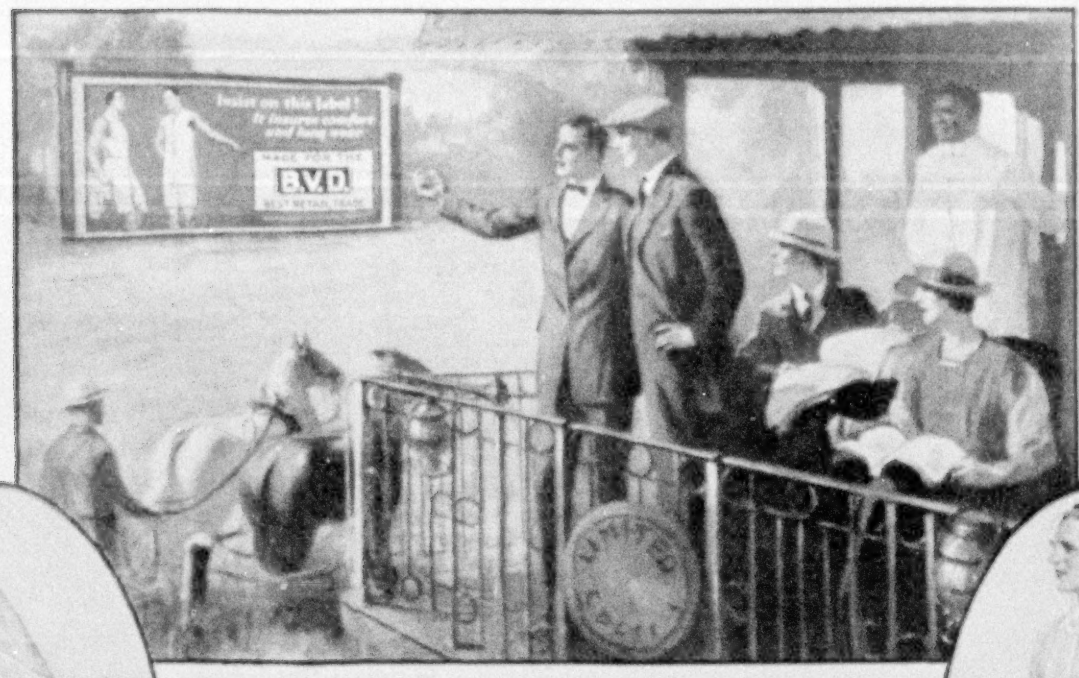

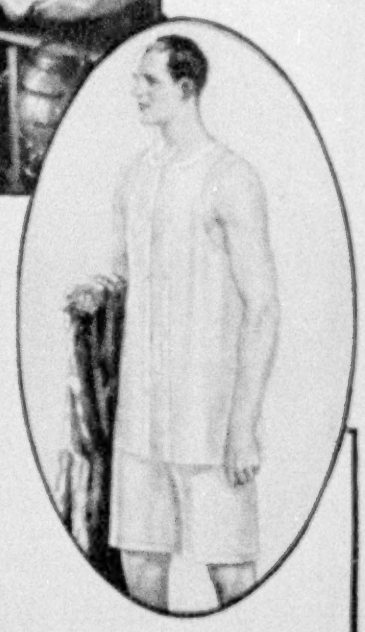

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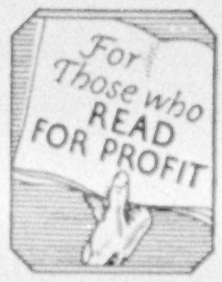

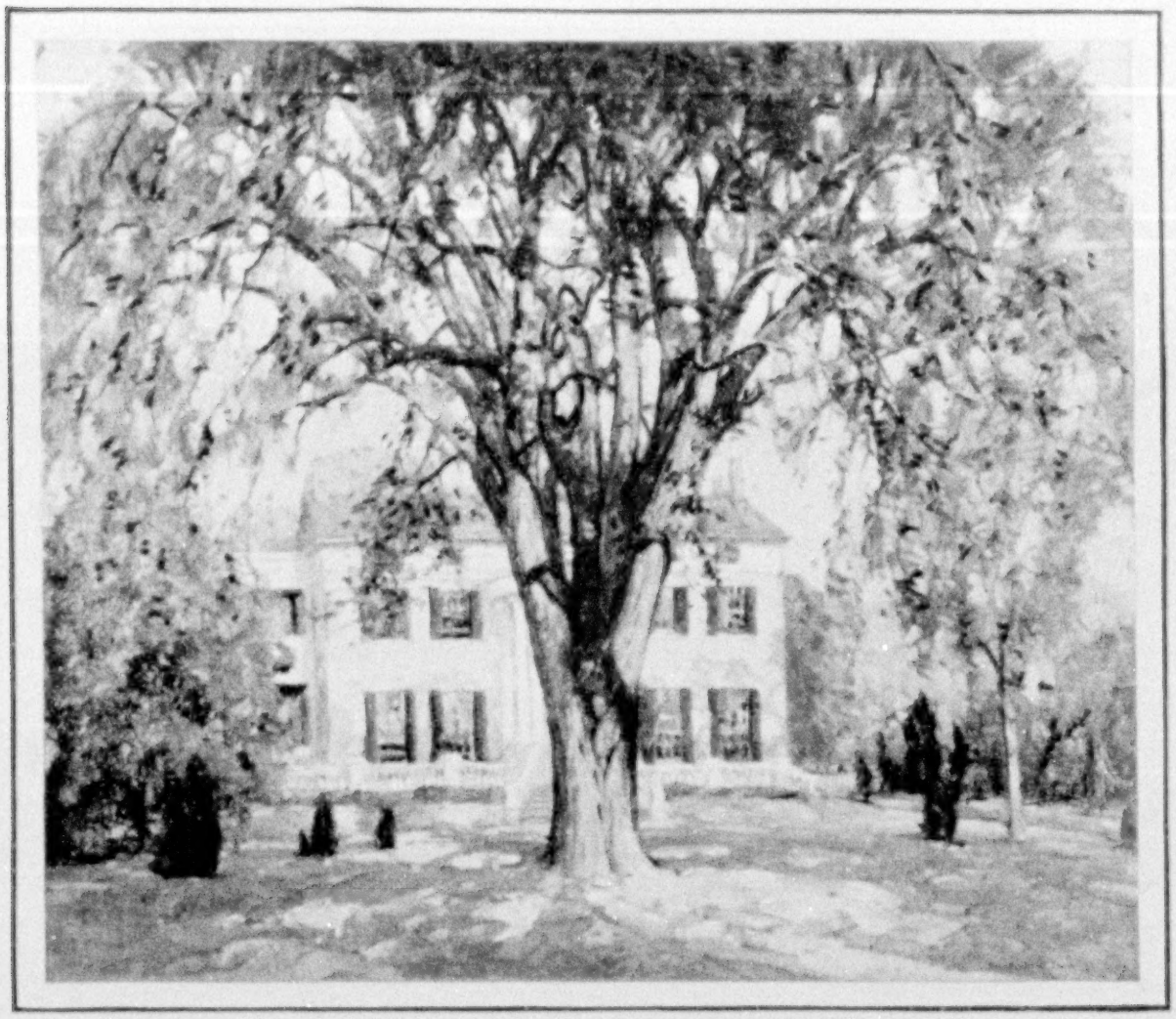

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Reproduction from a painting in oil, by Frank Swift Chase, of the home of Dr. Henry Van Dyke, Princeton, N. J.

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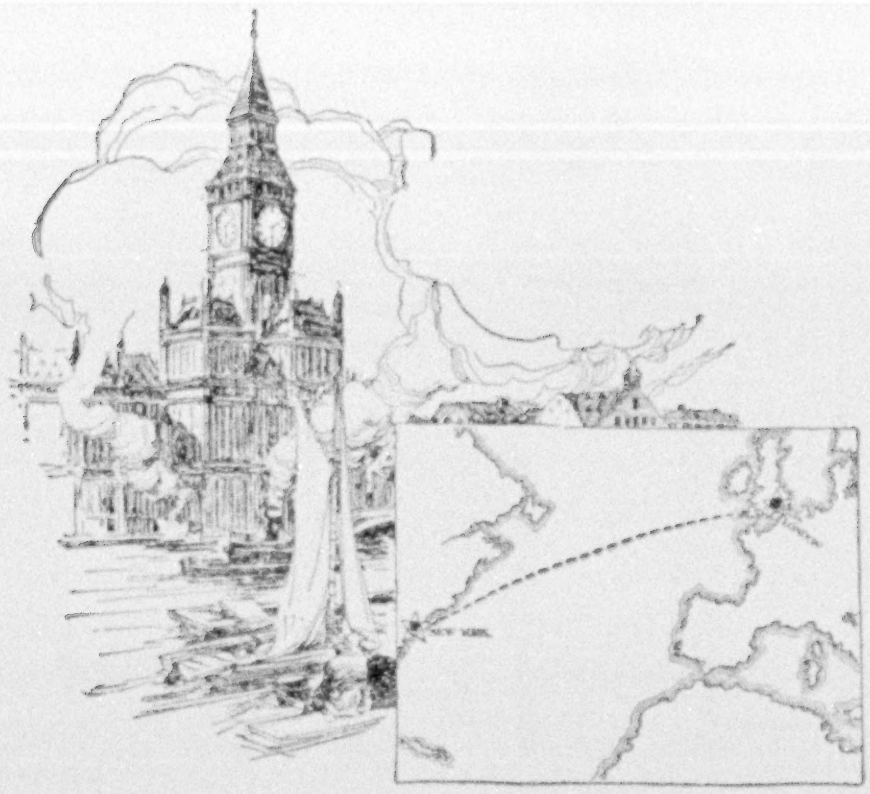

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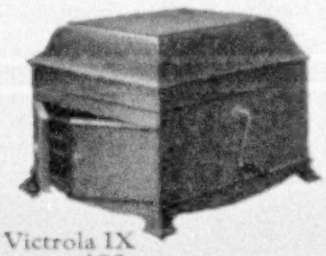

Victrola IX
$75
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Victrola No. 220
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Victrola No. 220, electric
$240
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Victrola No. 240
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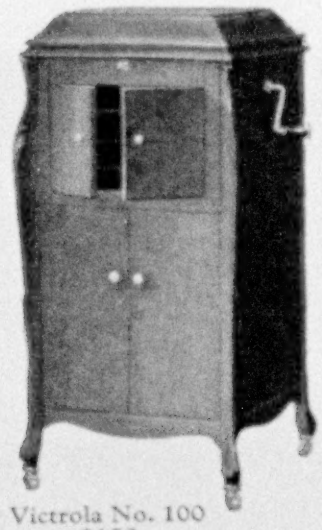

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VOL. XLIV, No. 1 WASHINGTON JULY, 1923

THE NATIONAL GEOGRAPHIC MAGAZINE

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THROUGH THE BACK DOORS OF FRANCE

A Seven Weeks' Voyage in a Canadian Canoe from St. Malo, Through Brittany and the Château Country, to Paris*

BY MELVILLE CHATER

AUTHOR OF "THE LAND OF THE STALKING DEATH" AND "EAST OF CONSTANTINOPLE," IN THE NATIONAL GEOGRAPHIC MAGAZINE

THERE are two ways of seeing Europe—through its front doors and through its back doors.

The first includes trains de luxe, bustling capitals, big hotels, and personally conducting guides; and the national front-door steps are scrubbed to a whiteness for your anticipated arrival.

The second leads you, by unfrequented paths, past the back doors of family life and native customs. Nobody knows you're coming, so you get the potluck and warm welcome accorded to an unexpected guest.

The back-doors voyager, whose patron saint is Robert Louis Stevenson, has a confirmed preference for doing it afoot or astride a donkey or a bicycle; but my companion and I, who wanted to see the back doors of Brittany and Touraine, decided against these time-honored modes of travel. We ordered a Canadian canoe through a London firm and wrote the French ministry for permission to navigate the rivers and canals of western France.

When we turned up at London, three months later, the canoe had arrived, but not the permit.

"Your application," explained the representative of a French touring bureau, "is doubtless reposing under the elbow of an official at Paris. It will be my pleasure to remove that elbow."

And after another month of letters, telegrams, and kindred humerus-stirring methods, we received a *permis de circulation* authorizing the free passage of "le canoë canadien, *Nageoma*," drawing so many centimeters of water and so many "of air," across French inland waterways.

"We don't know much about French rivers," we told the touring-bureau gentleman. "Which point of departure would you advise?"

He pondered for a moment.

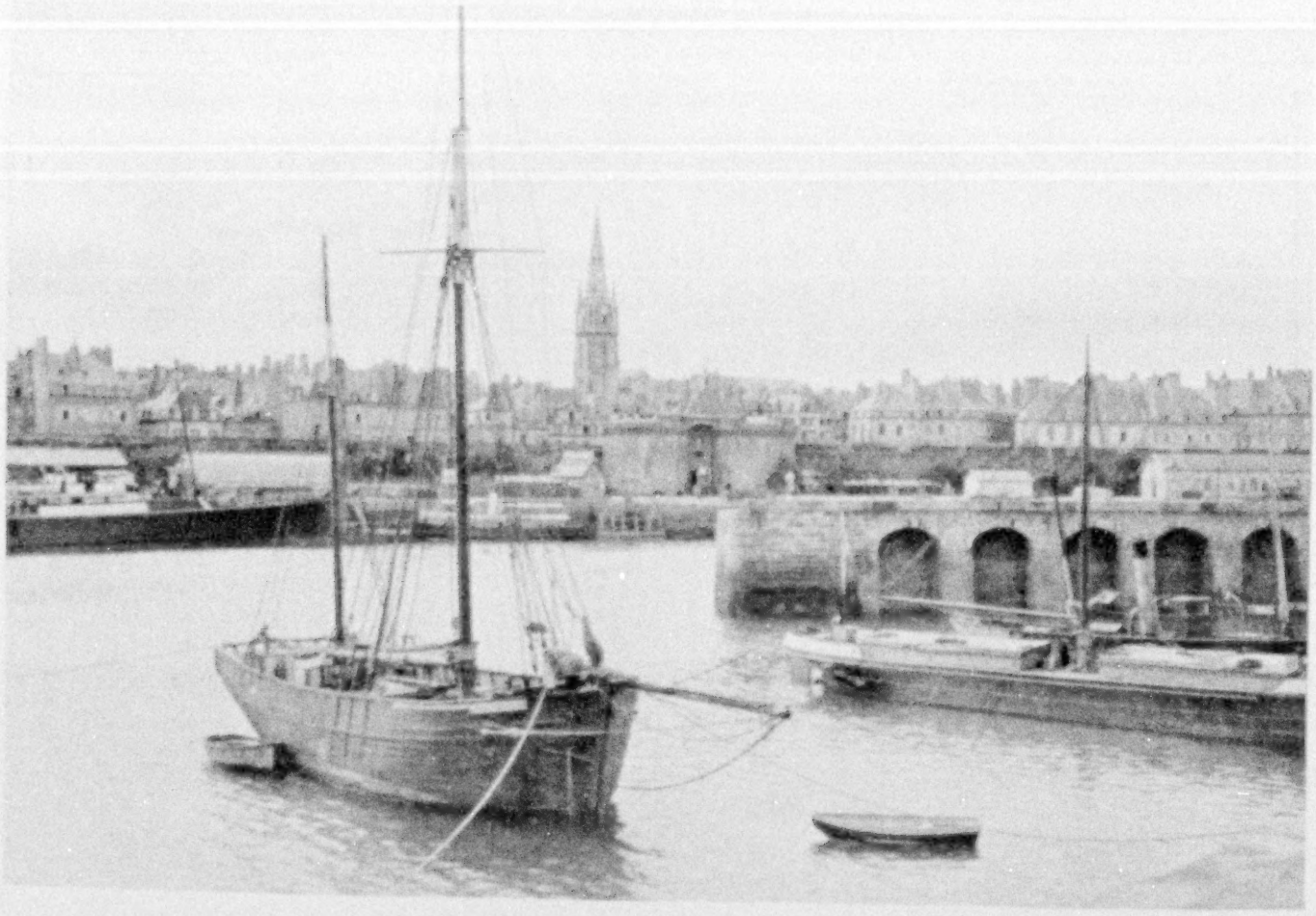
"La Rance!" he exclaimed with a sunny smile, "an inlet leading from St. Malo to the canal, you know. It's very simple. You just launch your canoe at the *avant-port*, turn to the left, and there you are!"

LANDING AT ST. MALO, IN BRITTANY

It sounded like A, B, C. That night we took the Channel boat from Southampton, and the following afternoon we sighted the coastline of Brittany.

Wide, wet sands where red-capped fishermen mend their nets, a tangle of narrow streets atop a fortified rock whose

* See also "Through the Heart of England in a Canadian Canoe," by R. J. Evans, in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1922.



Photograph by Emil P. Albrecht

ST. MALO, WHERE THE CANOE TRIP BEGAN

The towers of Grande-Porte, the city walls, the crowded houses, and the tall cathedral spire of the old channel fortress make a beautiful picture. At this port, the meeting place of ocean and channel tides, the difference between high and low water sometimes amounts during the equinoxes to nearly 50 feet.

turreted ramparts are grim with an age-long beating back of the sea and sea-borne invaders—that is St. Malo.

And something of this aloof grimness burns in the Breton's eyes. For centuries his ancestors breathed gray mists and watched the gray seas for the approach of enemy ships. Quite reasonably, then, he has a dourness and a suspiciousness of nature which sharply distinguish him from the light-hearted inlander, secure in sunny vineyards.

Just as every American town has its National House and every English town its Royal Arms, so every French town has its Hotel de l'Univers. But St. Malo goes even further than that. Said the *maître d'hôtel* to whom we applied for rooms, "The Univers is full just now, but we can accommodate Monsieur and Madame in the Annex of the Univers!"

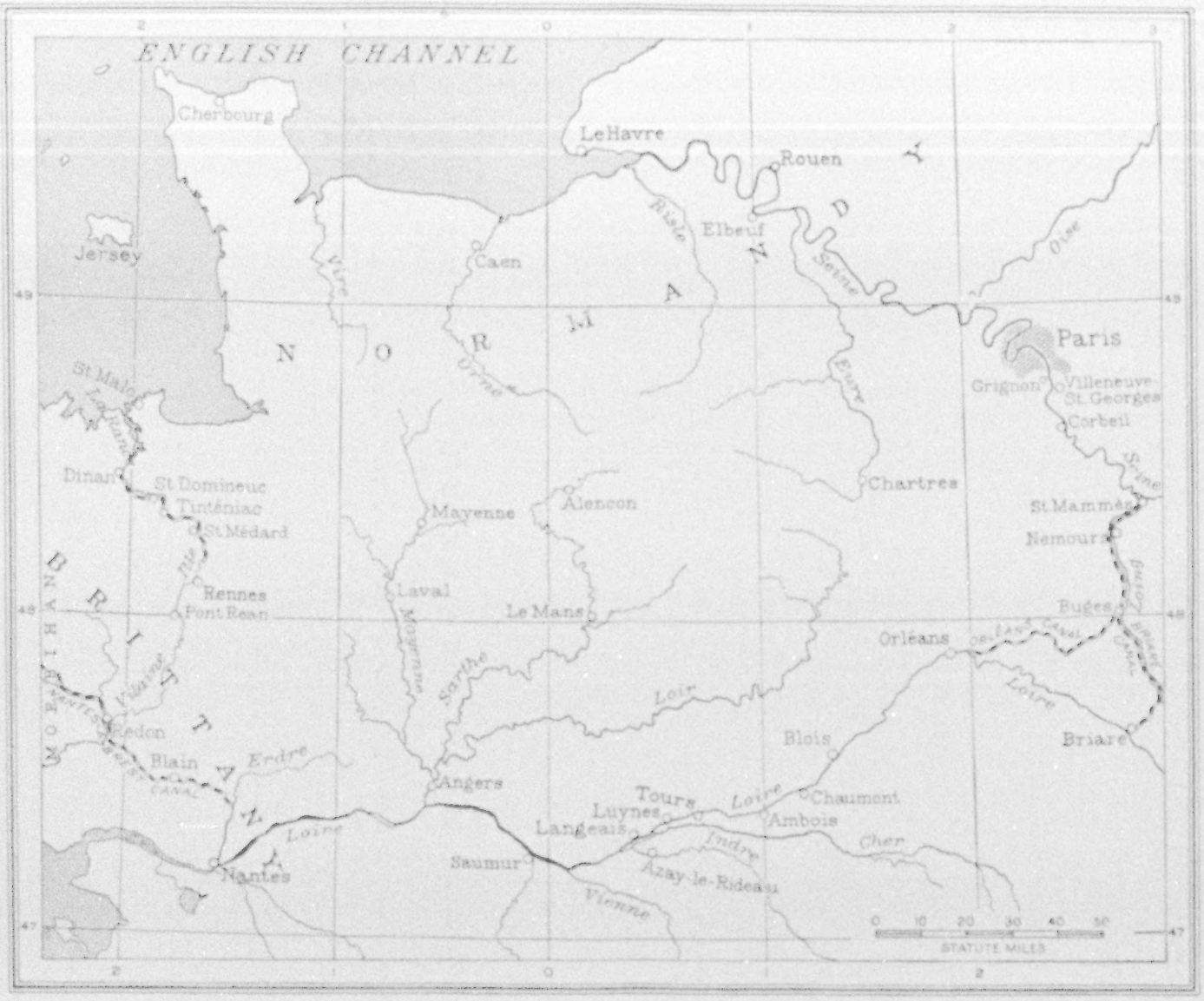
THE CANOE AND CAMPING EQUIPMENT

Next morning we went to the custom-house, where we found half a dozen Breton boatmen scratching their heads about the opened crate which contained our canoe.

The *Nageoma* was 16 feet in length. For camping purposes, it had been fitted with removable iron rods that supported a canvas awning with side and end flaps which could either be rolled up or hooked down along the gunwale, according to the weather (see illustration, page 6). It was equally simple to set up rods and canvas on the canoe or on the ground—an arrangement which afforded us, whether afloat or ashore, a rain-proof shelter 16 feet long by 3 feet wide.

Our equipment, consisting of army blankets, ground sheets, a water tank, a miniature field-kitchen, and even the nucleus of a library, was packed in duffel bags, which could be stored in the canoe and thus transported with it by rail or cart, whenever a carry was necessary.

That the thing in the crate was rudderless, motorless, sailless, without oarlocks or keel, and yet unmistakably some kind of craft, was what seemed to be puzzling the boatmen. They asked us what we



Drawn by A. H. Bumstead

THE ROUTE OF THE "NAGEOMA" THROUGH THE BACK DOORS OF FRANCE

Beginning at St. Malo, the seven weeks' journey included visits to Dinan, Rennes, Redon, Blain, Nantes, Angers, Langeais, Luynes, Tours, Ambois, Chaumont, Blois, Orléans, Buges, Nemours, St. Mammès, Corbeil, and Paris.

were going to do with it, and we replied that we were going to Paris in it. And when they had finished echoing "To Paris!", we explained, "By canal."

Then they comprehended at once; we were going to hire a donkey to tow us along the bank. But we shook our heads and showed them the paddles.

"Eight hundred kilometers by arm!" they protested. "But, M'sieu and Madame, there is a railroad!"

"Yes," we admitted, "but we prefer to do it *this* way."

Then the inspector examined our passports, so as to establish the nationality of our lunacy, and made out a receipt for the duties, which would be refunded if we exported the canoe and its contents within a specified period.

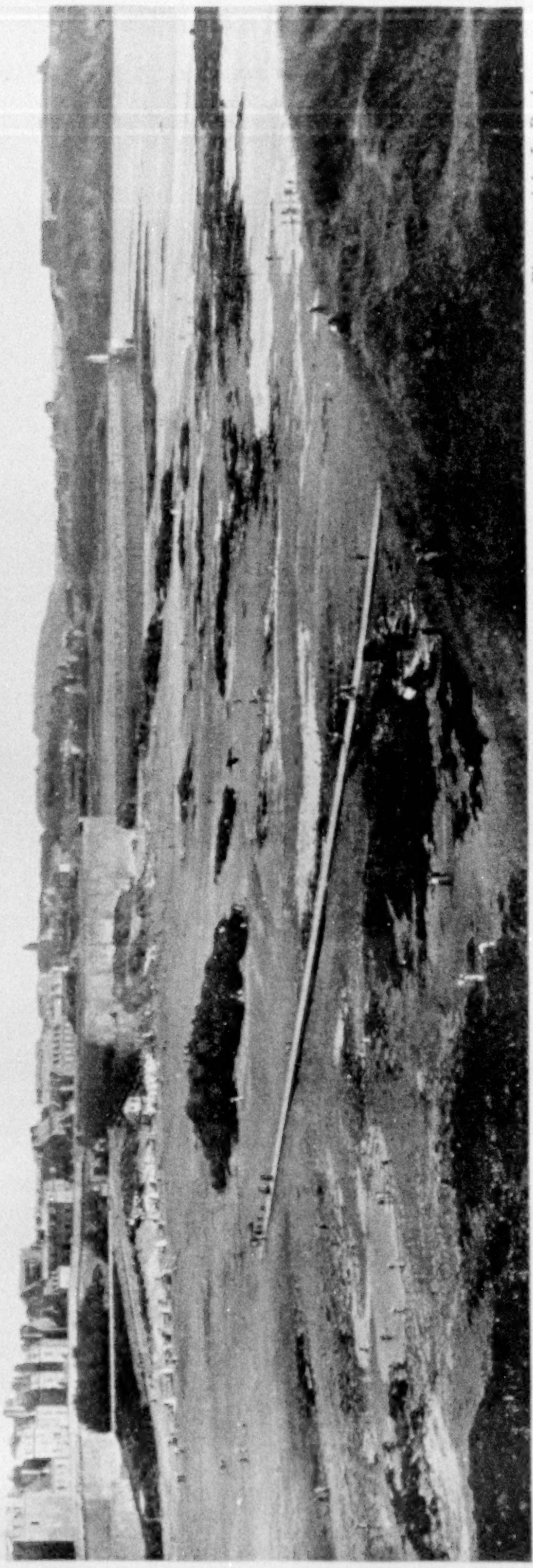
"To Paris?" he queried, as if to shake us from our resolve. And "To Paris!" we firmly replied.

For an instant he studied our muscular systems; then he said gallantly, "I will make your papers good for one year."

But to the last, I think he suspected that we had a pocket-motor concealed somewhere about us.

We carted the *Nageoma* across the town, attended by an ever-augmenting audience. Fishermen left their nets, and bakers their ovens, and *gendarmes* quitted their posts, and shrieking children dragged their nurses after them to swell our train. Certainly no battleship was ever launched amid more enthusiasm. But the faces of those knowing old Breton sailors gathered on the quay displayed less of an enthusiasm than a kind of morbid curiosity.

"There is a strong current in the Rance!" one of them called after us, as we headed across the harbor toward the low-banked stream which would lead us to the Ille-et-Rance Canal. But we only



Photograph by L. Boulanger

ST. MALO, WITH ITS ENCIRCLING 16TH CENTURY RAMPARTS AND THE BEACH OF THE GRAND BEY

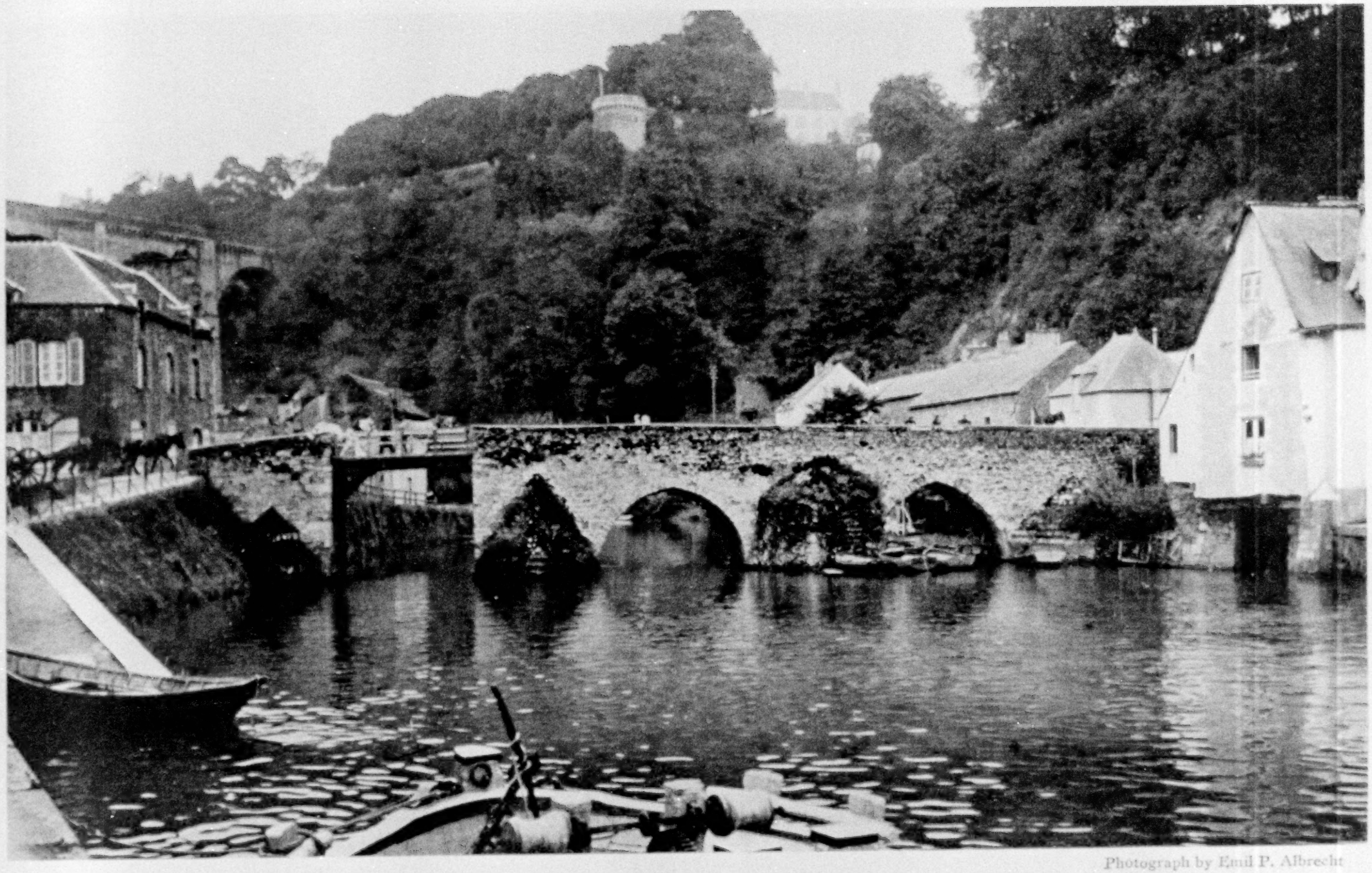
The beautiful Bay of St. Malo is dotted with numerous fortified islets, one of which is Grand Bey, to which it is possible to walk dryshod from the mainland when the tide is out. The tomb of Chateaubriand is on Grand Bey. Jacques Cartier, discoverer of the St. Lawrence River, was also a native of St. Malo.

waved a cheery farewell, confident of what our tourist-bureau friend in London had told us—that La Rance was simplicity itself; that you just turned to the left and there you were. And in fact an innocent-looking stream it appeared—a winding, tree-crowned stretch of placid water not a thousand yards wide and, as our maps informed us, 22 kilometers in length. Nor was there even a noticeable current. What everybody had neglected to explain was the existence of a tremendous ocean tide.

That night the placid "stream" suddenly yawned into a rocky chasm, where the water dropped so swiftly that before one could say "Tide!" we found ourselves aground on precipitous crags.

What with the pitch darkness and the dangerous footing, before we could unload and relaunch our heavily burdened canoe, La Rance had laid bare another 20 yards of declivitous rocks. There was nothing for it, then, but to wait. So, perched aloft there among the oozy seaweed, we held on for six black hours until, at sunrise, La Rance returned from the nethermost depths and floated us off.

By noon we found ourselves gliding along



Photograph by Emil P. Albrecht

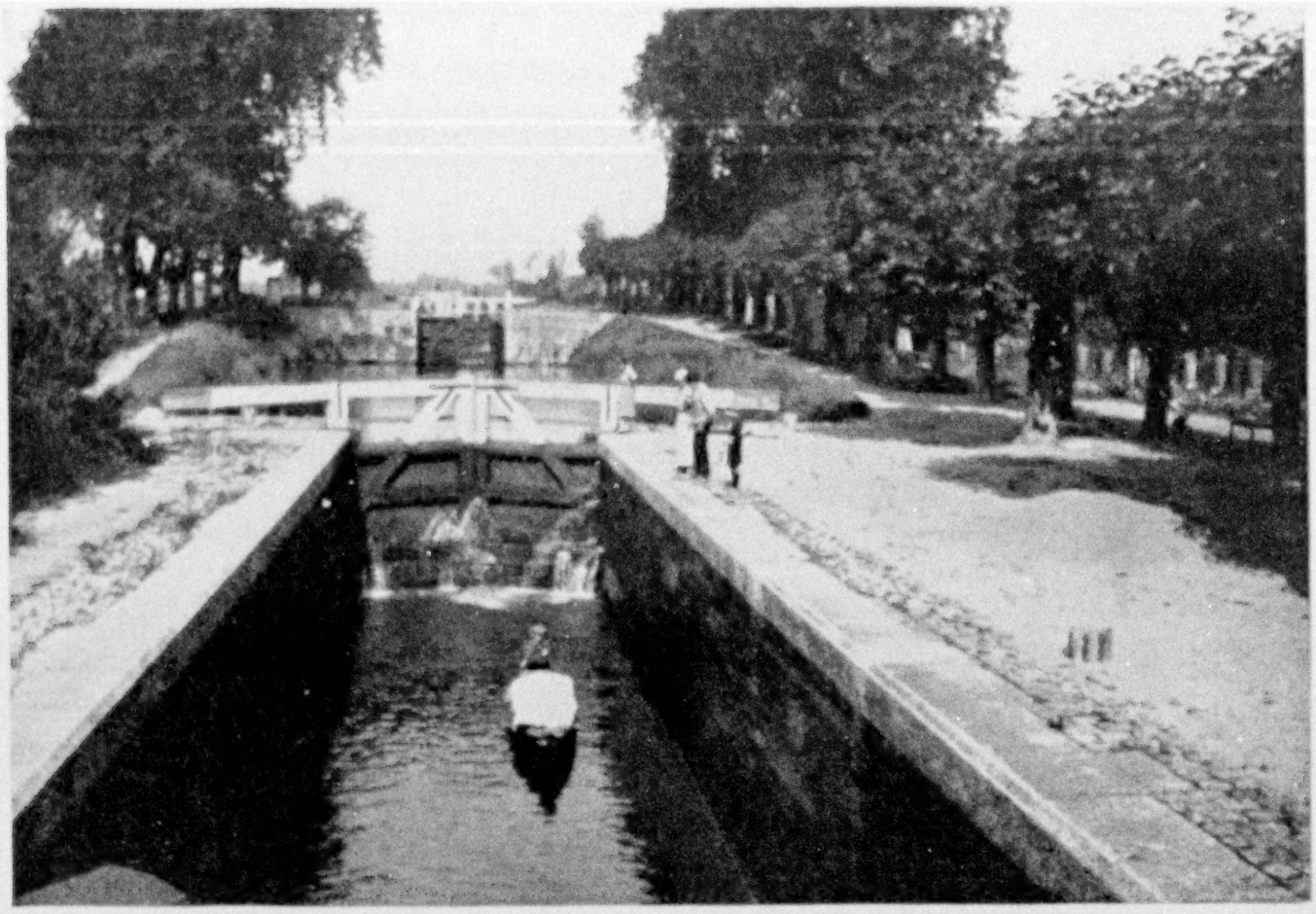
THE OLD GOTHIC BRIDGE ACROSS THE RANCE BELOW DINAN

THE "NAGEOMA" STRANDED AT LOW TIDE ON THE RANCE (SEE TEXT, PAGE 4)

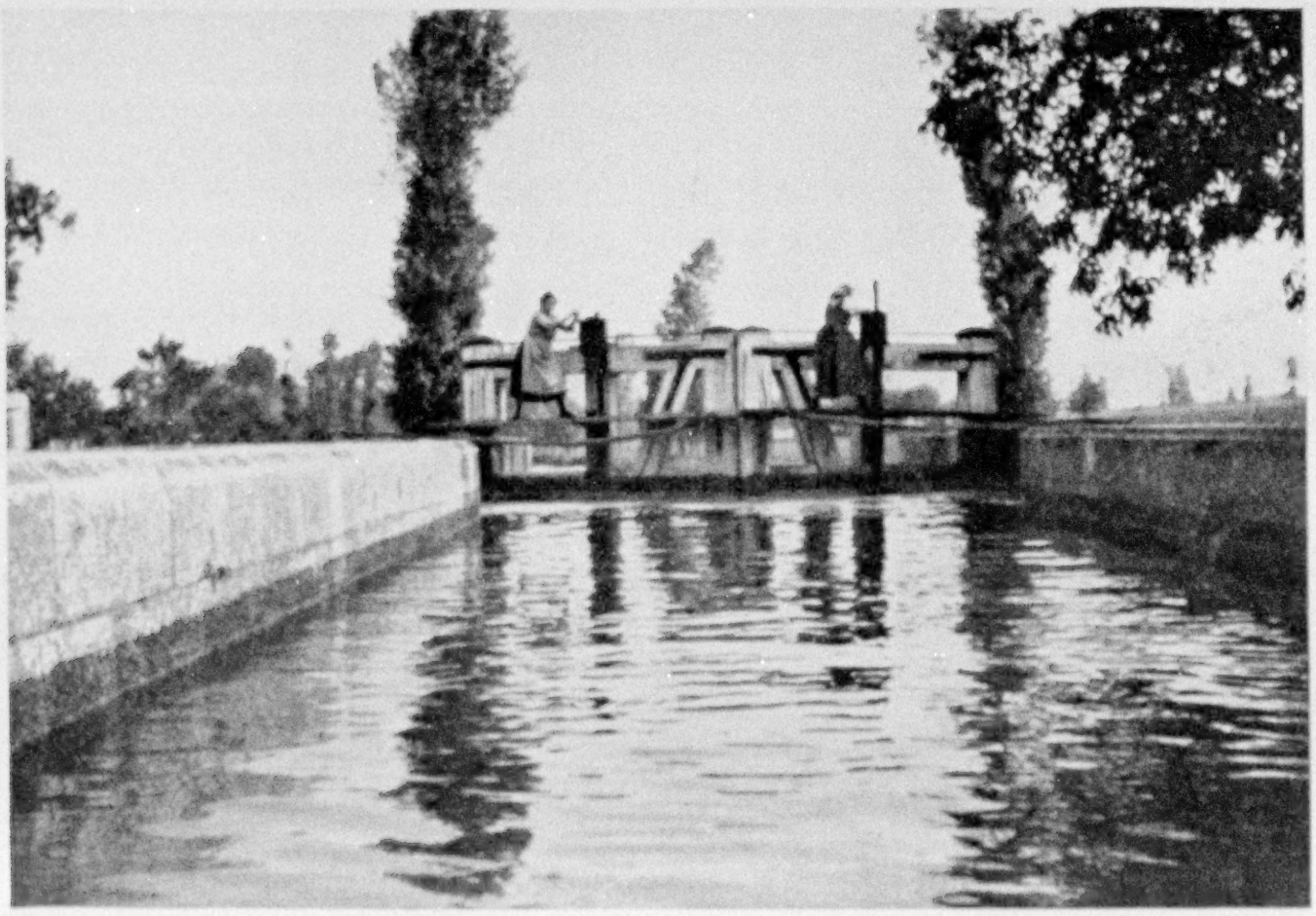
Photographs by Melville Chater

FLOATING ALONG THE ILLE-ET-RANCE CANAL

The equipment for the seven weeks' voyage on the rivers and canals from St. Malo to Paris included a 16-foot Canadian canoe, a canvas awning, army blankets, a miniature field-kitchen, and the "nucleus of a library" (see text, page 2).



PASSING THROUGH A DOUBLE LOCK (SEE TEXT, PAGES 10 AND 30)



Photographs by Melville Chater

A WOMAN OPENING LOCK GATES FOR THE "NAGEOMA" ON A DESCENDING LOCK

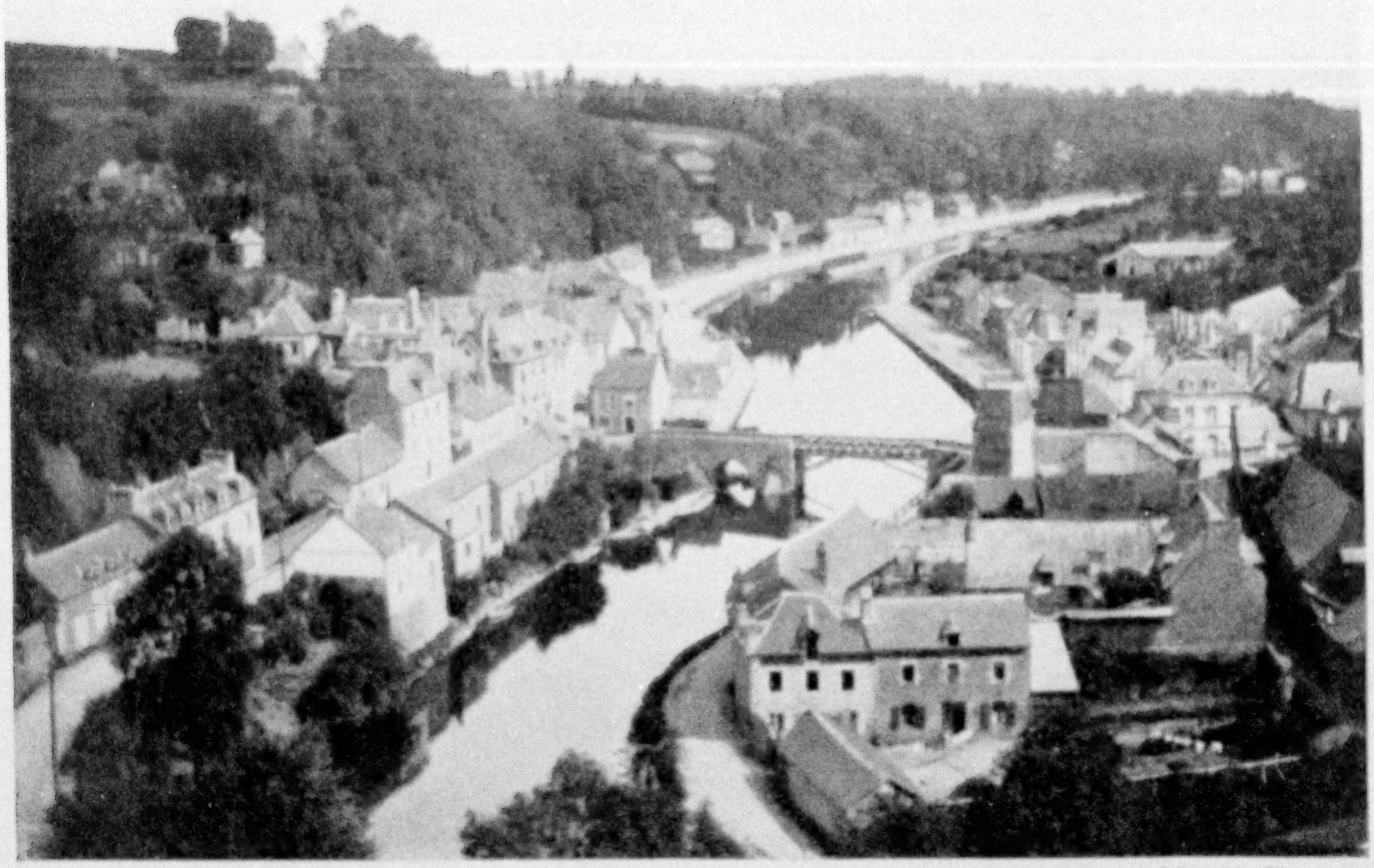
At the first lock the author's canoe narrowly escaped disaster when the lock-keepers turned on the sluices full force. One hundred and thirty-five locks are required to lift a boat from St. Malo to the Seine at Paris (see map, page 3).

MEN AND WOMEN ALIKE ARE THE HEWERS OF WOOD IN BRITTANY

Photographs by C. A. Slade

ALL THREE BEYOND THE AVERAGE WORKING AGE

But universal industry is the secret of the prosperity of Brittany, as of all rural France.



Photograph by Melville Chater

DINAN AND THE ILLE-ET-RANCE CANAL

This picturesque old town, 15 miles south of St. Malo, rises on the left bank of the River Rance.

between cornfields where farmhouses and fishing smacks, curiously intermingled, lay perched above La Rance on such steep heights that we had to crane our necks in order to get a glimpse of them.

We went ashore and climbed up 30 feet in order to ascertain just why Breton farmers kept fishing smacks in their vegetable gardens. We found a man seated on a good-sized yawl, whetting a scythe, while behind a 10-foot wall his wife was hanging out fish-nets in the cornfield.

"Excuse us," we said, "but are you a fisherman or a farmer?"

"Oh, that depends on the tide," he answered. "At low sea, one farms; at high sea, one fishes. That is because at low sea there is no water at all, and at high sea there is no land." And he consulted his watch.

"You don't mean," I asked, "that this stranded old tub will ever be afloat again?"

"In about six hours, M'sieu," he answered, "six hours after there is no water at all."

A disquieting thought seized us. We rushed down the hill and leaped into the *Nagcoma*. But it was already too late. Not water enough remained to float even a canoe. So we climbed the hill again to a deserted meadow, where we prepared to pass the night. Within an hour the lagoon over which we had come was a vast stretch of mud. Six hours later it was once more a wide lagoon, and the waters had climbed 30 feet and were rippling in across the meadow where we lay.

TIDE CAN OVERTAKE MAN ON HORSEBACK

Sunrise revealed La Rance washing against the 10-foot stone wall which protected the cornfield of our farmer-fisherman acquaintance, while he himself came sailing by us in his yawl, bound for St. Malo.

"You have but six hours to reach the first lock," he called to us, as we sat at our canned-goods breakfast atop a small, unsubmerged height, with the sea flowing all about us. "I advise you to hurry." And, knowing that what was sea would become dry land in three hundred and sixty minutes, we did hurry.

The tide in La Rance rises and falls from 25 to 50 feet, according to the sea-

son of the year. Low water exposes immense tracts of sand, across which one may walk dryshod—at his peril; for, once the rising tide is well under way, so I have heard Breton farmer-fishermen declare, its sweep across the flats is so rapid that a man on horseback, caught in the midst of a flat, cannot escape.

"You're just in time—very little water left!" called a voice, as we sighted the great lock which, at Le Châtelier, separates ocean from canal.

FACING DISASTER IN A LOCK

We paddled inside, the massive gates shut, inclosing us in a vault 16 feet deep; then ahead the sluices slid up with a deafening roar of inrushing waters!

The *éclusiers* (lock-keepers) had turned on both sluices at once, with full force; and the waters, falling from far above into an almost emptied lock, thundered about us like a tidal wave.

We knew well enough that, once broadside on, the canoe would immediately be dashed against the rear gates, and that our party would be over. However, we stuck to the task of holding her straight, while the waters boiled around us, lathering into a brown foam which crept over our gunwales; and now the frightened lock-keepers yelled directions to us and ran for life-preservers.

Happily, however, these were unnecessary. Inch by inch we were upbuoyed from the depths until over the edges of our masonry-lined vault—I had almost said tomb—there peered treetops, then red roofs, and at last the mild windings of a Corotesque stream, out upon whose levels we slid through the slowly opening lock-gates.

"How many more of these devil's bathtubs are there between here and Paris?" I called to the head keeper. He consulted his *Guide Officiel;* then called back cheerily:

"One hundred and thirty-four, M'sieu!"

Of course, we thought that he had misunderstood us; that he was quoting the death rate among canoeists overset per month in French canal-locks, or something of that kind. But the man insisted. Mentally we multiplied our recent experience by 134, and we didn't like the product. Then the lock-gates closed behind us, barring out the devouring ocean tides; and for a while we just sat blissfully at rest, drifting along the tranquil Ille-et-Rance Canal.

THE FRENCH ARE JUSTLY PROUD OF THEIR CANALS

Canal? The word is a libelous description of those idyllic streams which for seven weeks we followed across France. Instead of some inflexibly straight cut, imprisoned between stone embankments and suggestive of sewage, imagine sylvan windings innumerable, water lilies afloat, bank-bordering poplars a-march against the sky, and far ahead the subaqueous ghost of some woodland-embowered bridge dipped in the mirroring vista.

Such are the canals of Brittany and Touraine—sheer pieces of nature, pastoral symphonies. Old Izaak Walton would have loved their banks equally with the many sportsmen who come down from Paris for a week-end of fishing. The French are as proud of their canals as the Hollanders are of theirs, and with good reason.

Now, you may decoy a fish or dynamite him, or you may, like the canal fishermen of Brittany, employ an intermediate method. Just ahead of us on the Ille-et-Rance we espied a skiff whose sole occupant was pulling so furious a stroke that the water was lashed into foam all about him—this without his craft budging an inch. Presently we saw where the trouble lay: the idiot's anchor was down.

"Is he drunk?" I asked.

"Or is it Delsarte, or Swedish movements?" suggested my companion.

A FISH-FRIGHTENER AT WORK

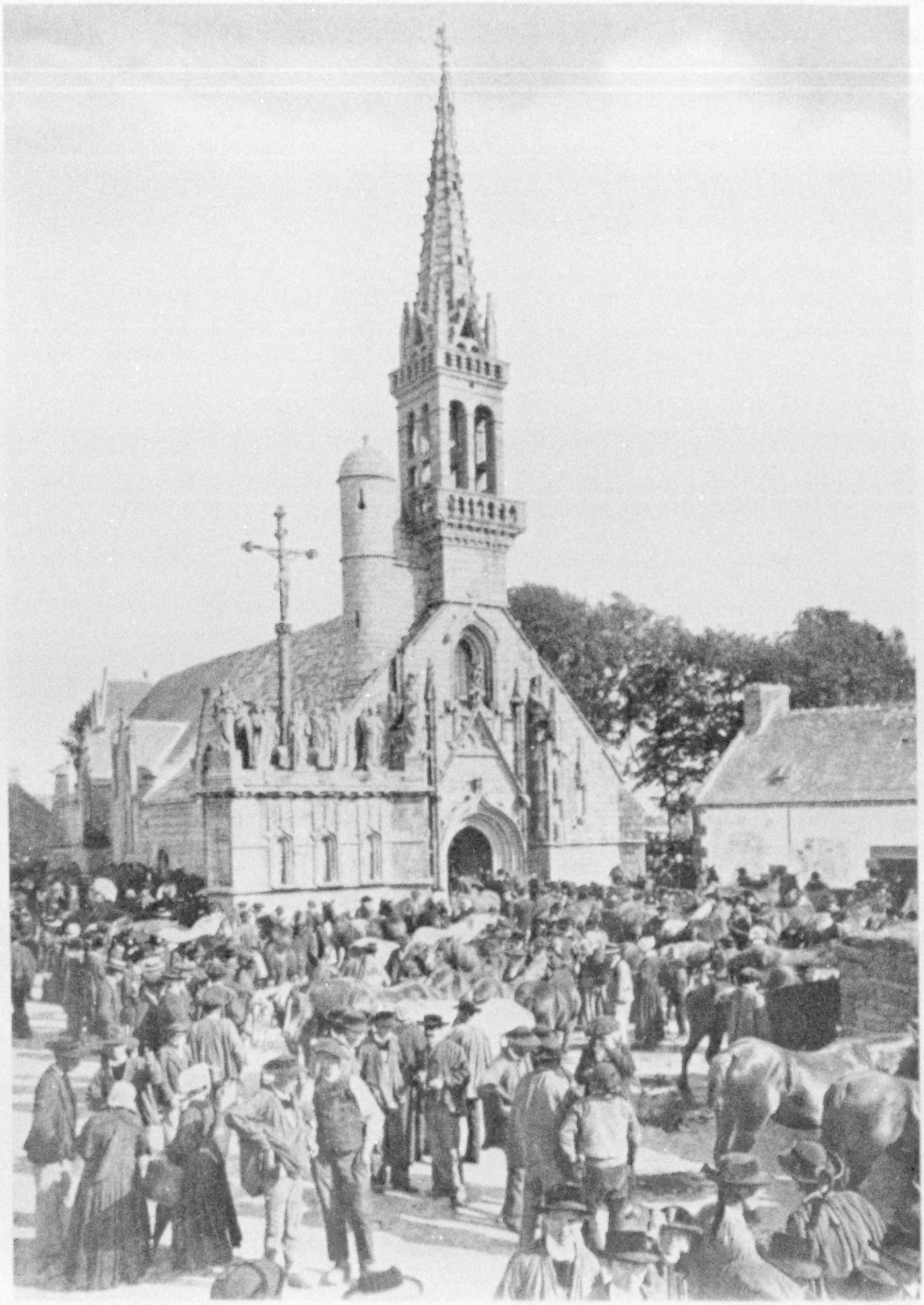
Then we rounded the curve and sighted the explanation—an adjacent smack wherein a second man was turning a crank which hoisted out of the canal a big, square scoop-net filled with small fry. Then back went the net, and again the stationary oarsman lashed the water white; for he wasn't an athlete—he was a fish-frightener.

After two nights spent amid rocks and mud-flats, the humble waterside inn which we found at Dinan seemed to us to warrant a super-luxury tax at the very least.

Photograph by Crété

CLEANING GRAIN BY THE OLDEST KNOWN METHOD

The wind is still driving away the chaff on most of the farms of this northwestern corner of France, whose inhabitants cling to their quaint customs, their curious legends and superstitions.



Photograph by Crété

THE PUBLIC SQUARE IN COMFORT ON A MARKET DAY

The hamlet of Comfort, which is six miles from Douarnenez, possesses a Gothic church erected in the 15th century and remodeled during the two hundred years following. In its nave there is a quaint Wheel of Fortune, with bells to invoke the blessings of Heaven.

Photograph by Crété

A SHRINE ON THE ÎLE DE SEIN, THE SENA OF THE ROMANS

The Île de Sein is off the coast of the westernmost point of Finistère, which is the westernmost point on the European Continent. In the early days this mound of sand and rock, whose inhabitants eke out a precarious livelihood by fishing, was the chief sanctuary of the Celts.

Photograph by Crété

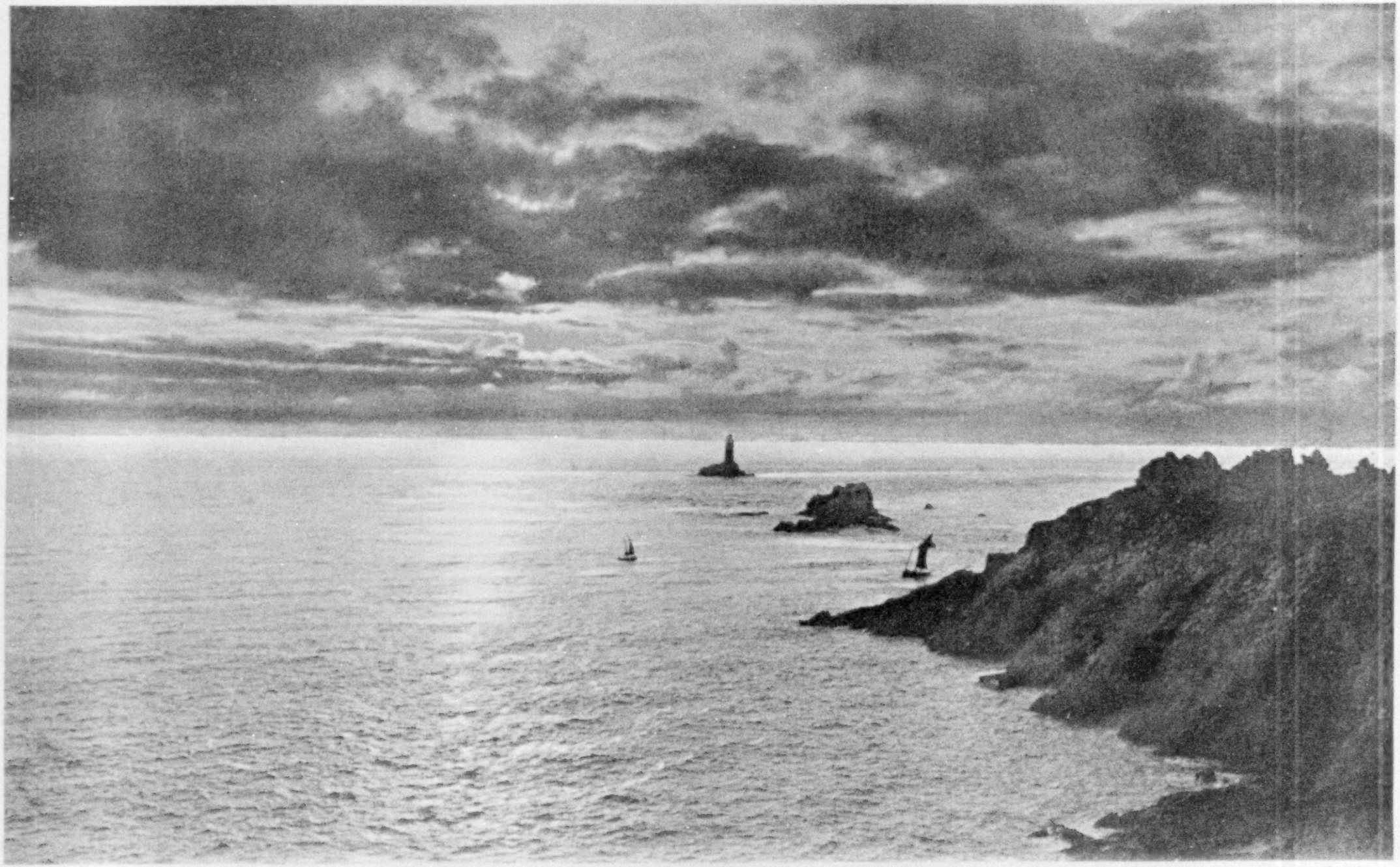
BRETONS OF FINISTÈRE PLAYING SKITTLES

Though the "alley" here is crudely hollowed out in the earth, skittles is related to our American tenpins and "ducks." The game is ordinarily played with nine pins set in a square upon a wooden frame, one angle of which is toward the player, who endeavors to knock down as many of the pins as possible in a throw.

XUM

Photograph by Crété

BRETONS AT THE DOUARNENEZ LAUNDRY TUB



Photograph by Crété

POINTE DU RAZ AT SUNSET

The passage between this rocky headland and the Île de Sein, five miles to the west, is among the most dangerous on the rugged coast of Brittany. The ancient prayer of the Breton mariners still serves the sailor to-day: "Help me, O God, in crossing the Raz. My boat is so small and the sea is so large."

XUM

Photograph by Crété

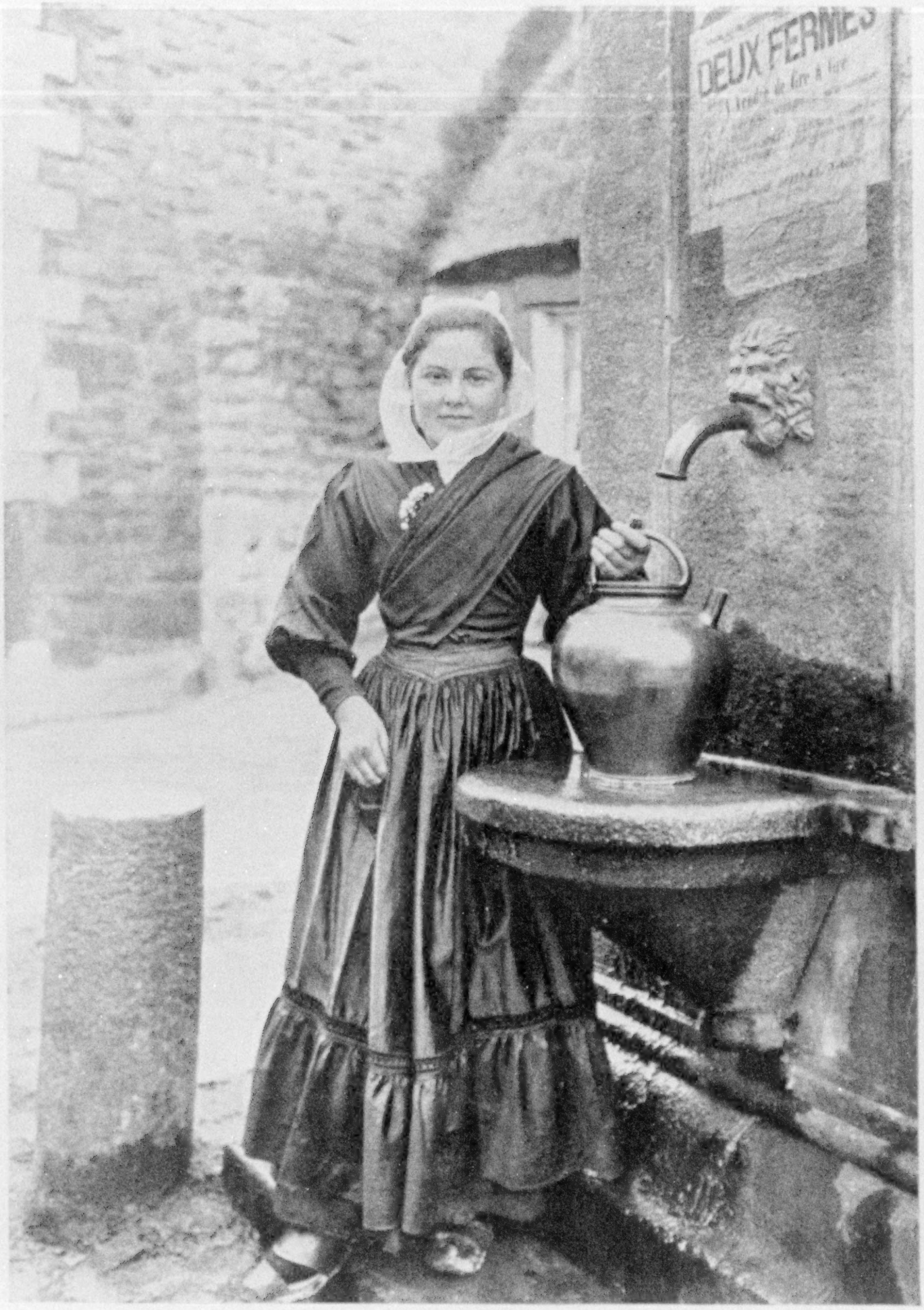
WOMEN ON A WHARF OF THE ÎLE DE SEIN

The social life of this little island clusters around its wharves and the two wells which supply the inhabitants with fresh water. The poetic Breton Angelus is still sung in its little church. The Druids left in stones a brief story of their life here, and Breton guides point out the submerged towers of the mysterious Ville d'Ys, the legend of which the composer Debussy has set to music under the title of "The Submerged Cathedral."

Photograph by Crété

A BRETON INNKEEPER

The Bretons are a simple, conservative, fearless, and independent Celtic people. Their native tongue is akin to the Welsh, and in many places in the interior French is not understood.



Photograph by Crété

A YOUNG LADY OF PLOUÉGAT-MOYSAN

Near her town is the chapel of St. Laurent-du-Pouldour, where on one night in August pilgrims make a circuit of the churchyard on their knees and bathe in a fountain as a preventive against rheumatism.

Photograph by Crété

HARVESTING FURZE NEAR PLOUGASNOU

This spiny evergreen shrub with tiny yellow flowers is found throughout western Europe, usually growing on otherwise barren heaths. In Brittany, as in other parts of France, it is used for fuel, while the tender shoots make good forage. The furze harvesters pack the shrub in mounds similar to our haystacks.

XUM

Photograph by Crété

PUTTING THE WEDDING KETTLES ON TO BOIL

There is no gayer festival in Brittany than a wedding celebration, sometimes as many as 1,800 persons being invited to a marriage feast. Often the tables are set in a horseshoe in a broad, green meadow, and the guests are served from a "field kitchen," the proud chief cook having borrowed for the occasion all the pots from the neighboring villages.

Photograph by Crété

WOMEN AND CHILDREN OF PLOUGASTEL

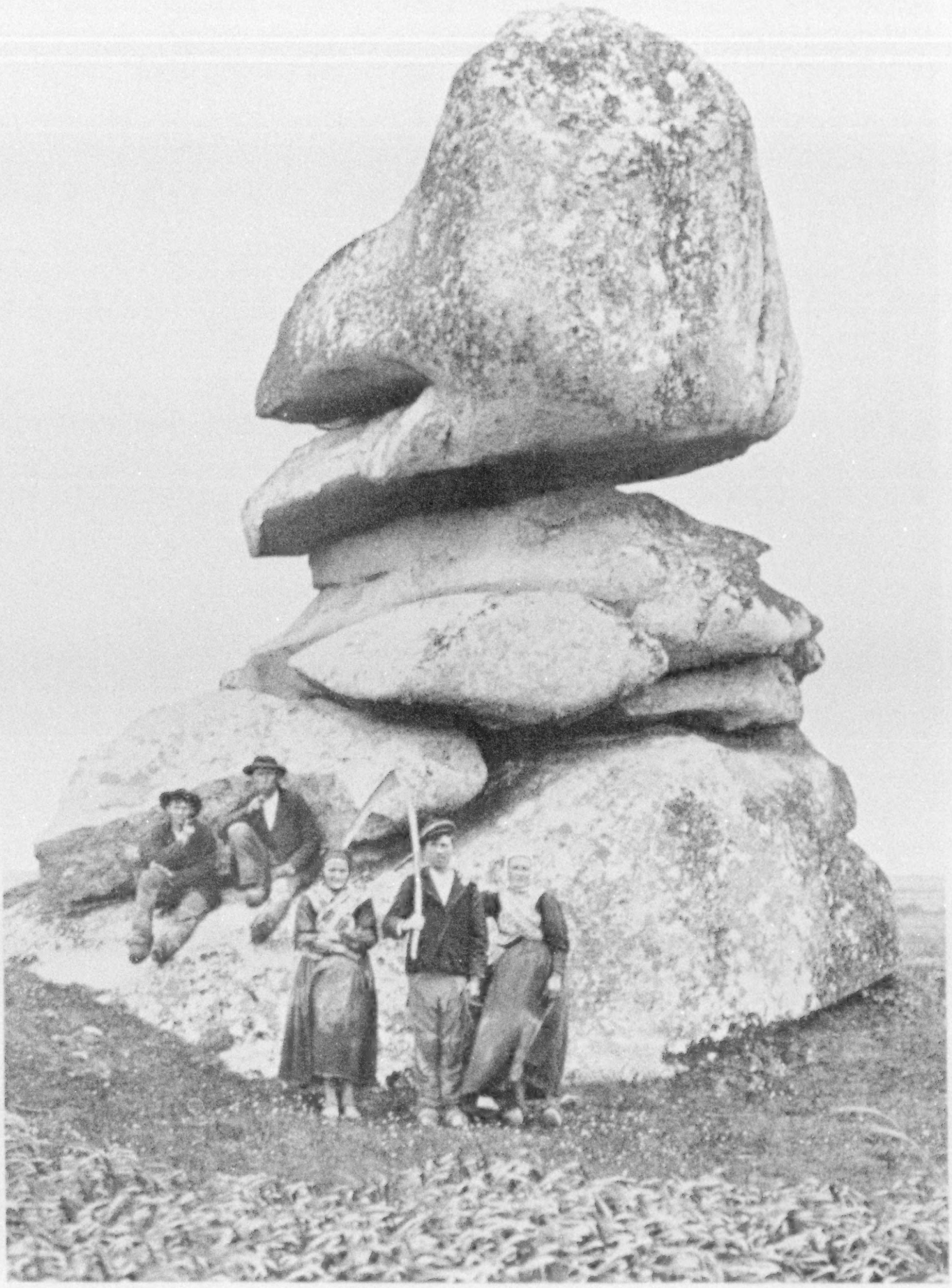
Just across the Elorn from Brest lies Plougastel, the market garden of Brest and of Paris, whose inhabitants have preserved their ancient costumes with few evidences of modern influence.

XUM

Photograph by Crété

BRETON WOMEN MAKING HEADDRESSES

The headdress of a Breton woman is one of the most distinctive features of her costume. She always keeps it freshly starched, and no matter how hard it rains in that rainy country of hers, she manages to arrive at the end of a journey with every crimp in her cap just where it should be.



Photograph by Crété

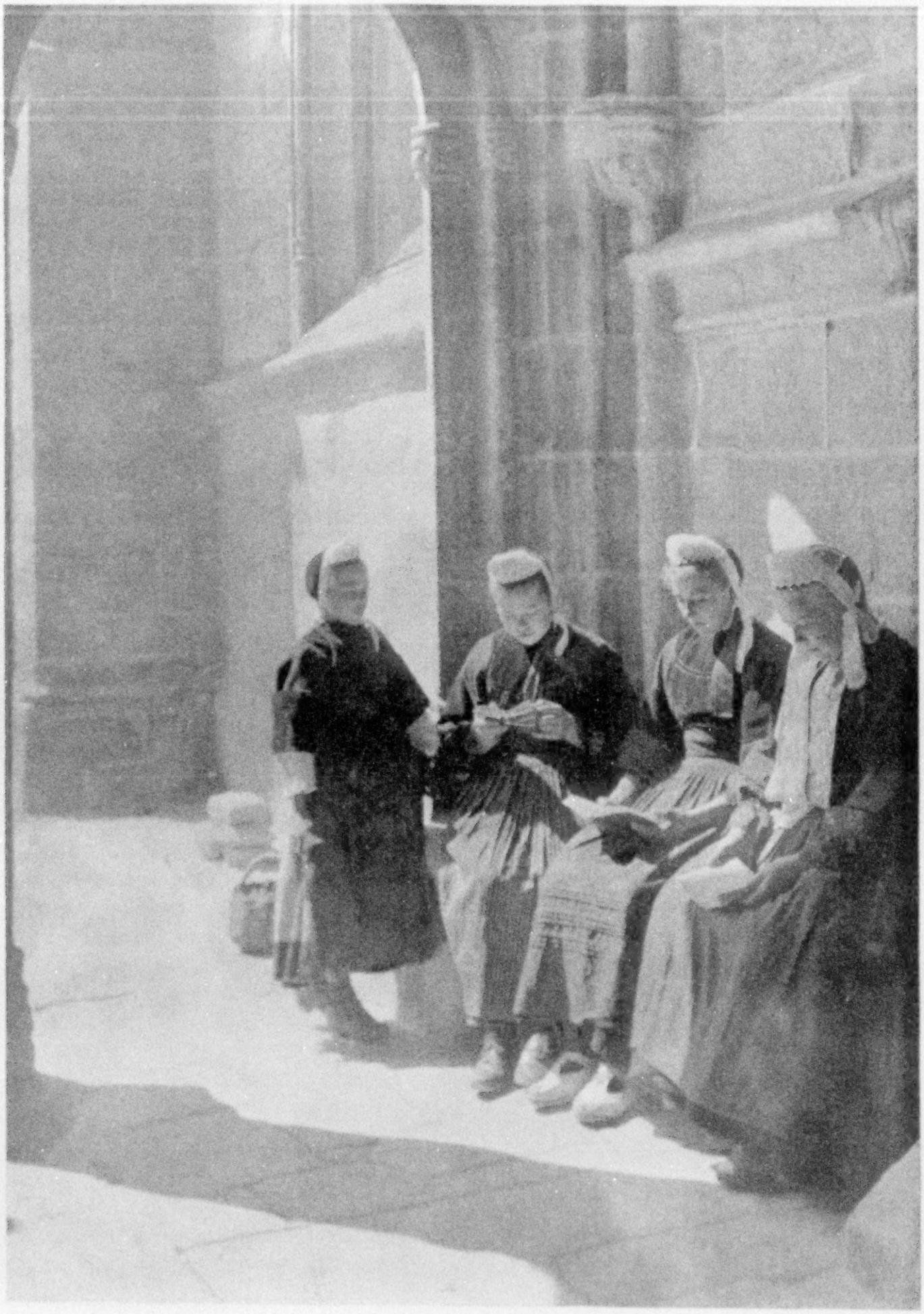
THE BRENN ROCK ON THE ROAD FROM SAINT-POL-DE-LÉON TO PLOUESCAT

The road running from Saint-Pol to Plouescat, on the way to Brest, passes through some of the most primitive country in Brittany and is bordered by not less than 30 curious crosses and wayside shrines.

Photograph by Crété

KNITTING SOCKS FOR FATHER AT ROCHEFORT-EN-TERRE, IN MORBIHAN

Since the landscape painter Pelouse brought the country around Rochefort-en-Terre into vogue, it has been the center of an ever-growing artist colony. Its commanding position above the river Arz and its château ruins furnish fascinating subjects for pencil and brush.



IN THE SHADOW OF A BRETON CATHEDRAL.

Partisans of Breton peasants maintain that they are the most devout people of France and their province has been called "the land of calvaries and pardons." The five great Pardons of Brittany are among the most impressive religious festivals in Europe.

Early next morning the declivitous streets were a-clatter with high, two-wheeled pony-carts containing blue-smocked farmers and their white-capped wives, on their way up to the market place, atop the hill. And there we found them gathered, some holding baskets of eggs, others with chickens under their arms or with haltered calves beside them, and all displaying a clean, starched, Sunday-like air of ceremony.

Great bargain-buzzings and the clap of sabots resounded through the quaint streets whose fifteenth-century house-walls and carved façades befittingly framed that scene of snowy-capped old women and shovel-hatted old men, with their shrewd, kind faces of apple-red freshness. Never were such old folk as those Breton peasants—old, merely, like some seasoned vintage of "imprisoned sunshine."

SCENE OF COMBAT BETWEEN DU GUESCLIN AND THOMAS OF CANTERBURY

From his near-by pedestal Bertrand Du Guesclin, constable of France—he and his steed, armed cap-a-pie—looked down on the square where, some six hundred years before, he had overthrown Sir Thomas of Canterbury in single combat. The dispute between the gentlemen centered about the propriety of landing English troops on Breton soil.

I daresay Sir Thomas pointed out that his Celtic countrymen had been emigrating thither ever since the fifth century, and that he mentioned the protection of minorities, adding that, indeed, the name Brittany meant no more than Little Britain. And I daresay that Du Guesclin retorted with, "Take out your Celts, then. France for the Franks!"

It was a divided victory; for while Du Guesclin, whose heart lies buried under a slab in the church of St. Sauveur, expelled the English troops from Dinan, the Breton Celts remain unchanged to this day, there being no less than a million of them who speak their Welshlike tongue and whole communities which possess not a word of French.

Regretfully we paddled away from charming Dinan; nor did we see another town until, five days later, we reached Rennes, 65 kilometers distant. It was all "little country," as the French say, with here and there a cluster of red roofs, or a distant spire, or lock-keeper's house, to add their charm to that canoe-tempting stream on which no canoe had ever been.

A COLLAPSIBLE OUTFIT

We mustered our kitchen equipment, set up our canvas awning, and padded the *Nageoma's* mid-space with blankets to a thickness of several inches. This gave us a clear ten feet of lounging room and allowed three more feet at each end of the canoe for storage.

You can do much even with a rather narrow 16-foot space if you will observe the principle of mobility and collapsibility. For the sake of convenience, the *Nageoma's* middle thwart had been rendered removable. Its position was usually occupied by our camping-table—a board two feet wide, fitted to rest athwart on the gunwales.

In addition to this folding-table, we carried collapsible food-containers, a collapsible oil-stove, a folding anchor, a folding water-bucket, and folding cups and cutlery. "You don't happen to have folding hatchets, frying-pans, and flat-irons?" we had jocularly inquired of the salesman at the Collapsible Supplies, Limited, in London. And, without a smile on his stolid face, he had promptly produced the trio.

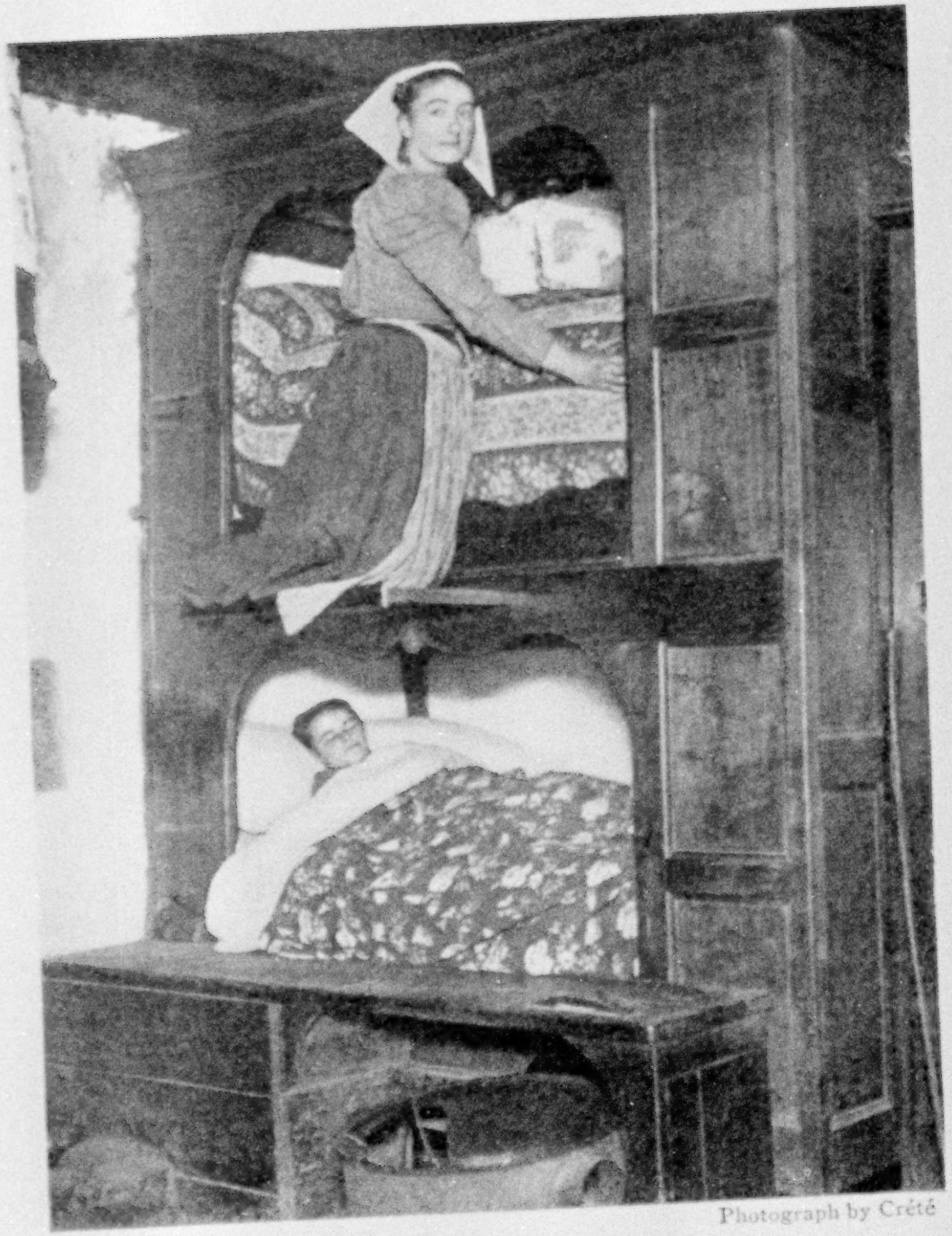
I suppose the *Nageoma* to have been the first canoe to cross Brittany because, until our arrival at Nantes, we met no one who had ever seen such a craft. Indeed, except at Nantes, we encountered no pleasure boating until we reached the Seine. The sensation which we created along those quiet countrysides in the Department of Côtes-du-Nord was extraordinary.

As our green-canopied craft glided past, the "man with the hoe" forsook his traditional Milletesque posture and came leaping across his turnip patch to stare. Women kneeling on their wash-boxes along the bank ceased scrubbing and sheltered their astonished gaze with suddy hands. Whole families, from grandparents to toddlers, hurried forth from some thatched farmhouse to exclaim rapturously, "That's *chic*, that is!" or, "What a *gentille* promenade!"

A MAID OF BRITTANY

Photograph by Crété

THE TWINS



Photograph by Crété

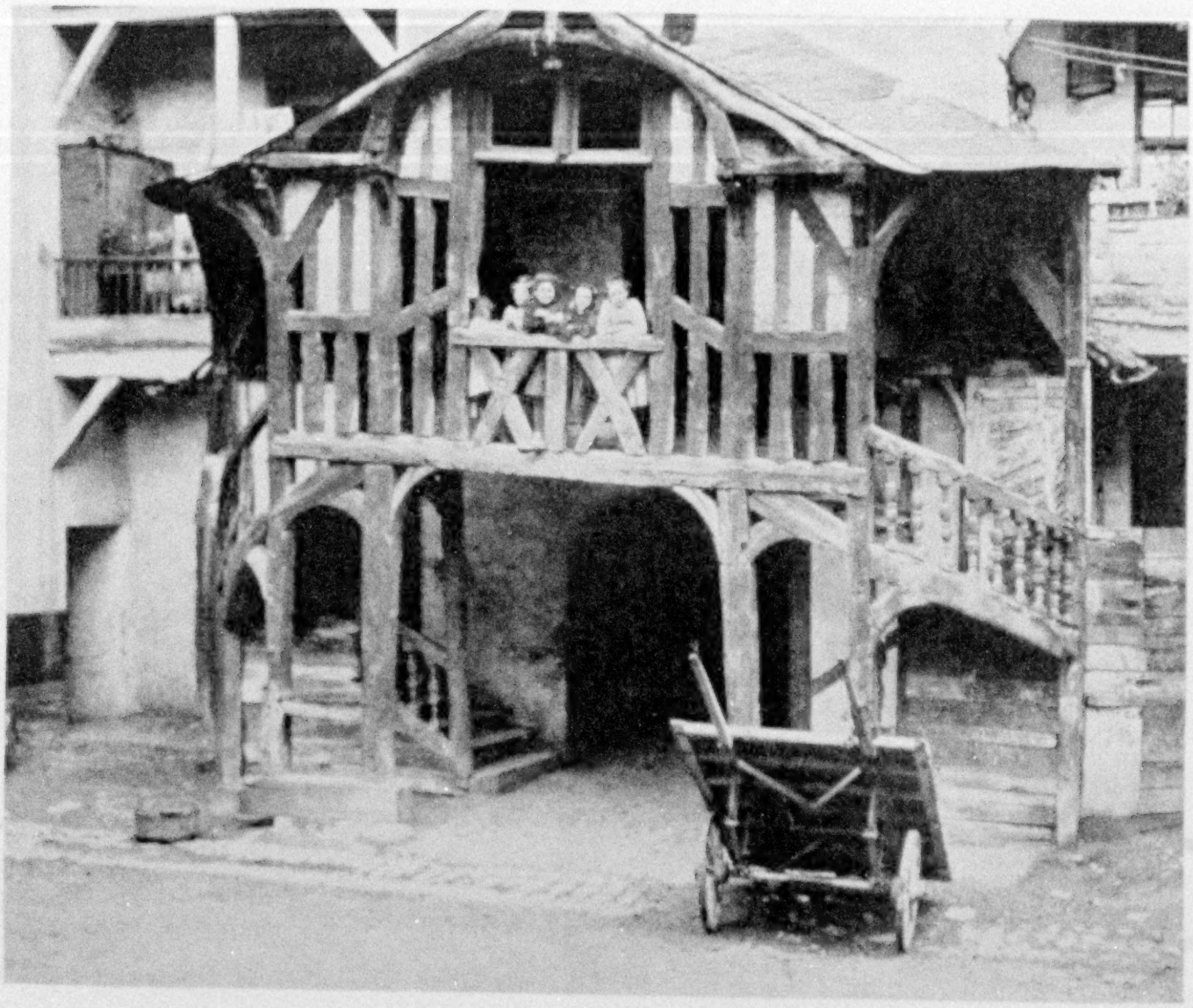
A TWO-STORY BED IN A BRETON COTTAGE

These curious compartments look as if they might have furnished the genesis of the idea for the Pullman berth.

Photograph by Emil P. Albrecht

MARKET DAY IN RENNES

With her arms full of baskets and baby, she offers her wares for sale in the ancient capital of Brittany.



Photograph by Emil P. Albrecht

ONE OF THE FEW RELICS OF MEDIEVAL RENNES

Part of the ancient Convent des Carmes, founded in the 15th century. The old wooden staircase, with its slate roof, clings to high houses with open galleries, now tenements, but once imposing residences. This old city of the Celtic tribe of Redones was almost completely destroyed in 1720 by a conflagration which raged for seven days.

Stupefied cows mooed at our approach; canal-boat drivers covered the eyes of their shying horses; and draft-dogs, hitched to handcarts, barked furiously as we overtook them. One inquisitive old dame trudged alongside us for quite an hour; and when at noon we rolled up our side-curtains and set forth stove and luncheon impedimenta on the camping-table, she sat down heavily, exclaiming, "*Mon Dieu*, but it is a little hotel!"

NEGOTIATING A LOCK IS A PICTURE-BOOK EXPERIENCE

Locks, locks, and locks! During the first five days we passed through 48 of them, and once we encountered 13 within four miles.

It was an off season for canal-boat traffic, and, in fact, during the first 200 kilometers we glimpsed no craft of any kind; the waters were all our own. Though this was not without its charm, we often had to climb ashore and search the countryside for the éclusier who customarily cultivates his garden during the slack season. When once we had found him afield, the conversation was invariable:

"You would pass the écluse, M'sieu?"

I nod assent; then follow him to his little house, which gleams snowy white amid its mazy flower garden and red-fruited apple trees.

"You have authorizations, M'sieu?"

I tender my papers and he stumbles at once upon the strange word, *canoë*.

"You have come from far, M'sieu?"

"From St. Malo."

He has been studying me, albeit po-

Photograph by Topical Press Agency

A CARTLOAD OF BRITTANY CHILDREN

litely, quite as much as he has been scrutinizing that unknown word, *canoë*, and I judge that he takes me for some eccentric millionaire with a steam yacht.

"The tonnage of your boat—it is considerable?"

I lead him to the waterside, and he glimpses the *Nagcoma*. After a prolonged stare, he goes off; then returns with a couple of enormous life-preservers, which he gravely hands to us before opening the lock.

But, thanks to the good-natured éclusiers, who would always moderate the water's inrush by opening the sluices gradually, our unpleasant experience at Le Châtelier was never repeated. In fact, locking through—and especially in "descending" locks, where the water sinks to the level of the stream ahead—becomes even an absorbing, picture-book experience. Down you go, gradually losing sight of the world, as the lock walls rise towering about you. The ponderous gates ahead of you, closed like some big, black book cover, set you to wondering what lies behind them. Then slowly they open—the book covers part—and some new and charming picture, a Corot or perhaps a Cazin, is disclosed.

IN A BRETON PIG MARKET

Photographs by Emil P. Albrecht

A CORNER IN THE SHEEP MARKET OF A BRETON VILLAGE

The fact that it is raining and the animals are huddling in an effort to find shelter gives them the appearance of being camera-shy.

Photograph by Crété

BRETON FISHERMEN WITH THEIR CATCH

Photograph by Emil P. Albrecht

A RAINY DAY IN A BRETON CATTLE MARKET

The women are quite as keen as the men at buying and selling pigs, sheep, goats, and cattle. White caps and gay aprons are as numerous as smocks and velvet hat-ribbons.

Photograph by Melville Chater

"WE CAUSED VARIOUS EMOTIONS AMONG THE RIVERSIDE WASHERWOMEN AT THE BACK DOORS OF FRANCE"

The washerwoman kneels inside her small box and thumps and paddles the linen on a board which extends from its front end. It looks rather like a wheelbarrow without a wheel.

Photograph by Crété

DRYING BRETON BONNETS

At Tinténiac we rested for a day at the inn, if you could so name a clean, paved kitchen with great crocks on the open fireplace, with sausages festooned along the rafters, a cider-press in one corner, and tables of cherry-wood, smooth and rich as old satin. And here the peasant-folk quaffed bowl after bowl of Brittany cider, and the lame lock-keeper recounted to us the manner of his receiving his seven wounds, when on the Marne in 1914, his ammunitionless regiment had fought *"à la fourchette,"* as he said, with a bayoneting gesture.

EVERY BRETON VILLAGE HAS ITS WAR MEMORIAL.

Yes, although Brittany's *"petits pays"* smile with corn and orchards, and her farm hands grub cheerily in the fields for 15 hours daily, and there is always a genial welcome for the back-doors traveler, those tiny village churches of hers, where the plain shaft stands to commemorate "1914-1918," tell the same silent story. *"St. Gatien to his children who died for France."*

Or it may be St. Domineuc, or St. Grégoire, or St. Médard, or other of those early fathers after whom Breton communities are so devoutly named. There may be 200 people in the village and there are 25 names on the shaft. Truly, each towering cross, with its gigantic figure nailed thereon, which for centuries has dominated the one straggling street of each Breton hamlet, has its renewed significance to-day.

At Rennes, where everybody save those actually in jail was surging on the bridge to greet us, we locked through into the Vilaine River. It was another lovely stream, which wound its way through a flexuous, closely shorn land of, one might almost say, natural golf links.

Perhaps it is an indirect compliment to the beauty of French waterways that this one should be called Ugly River. Certainly the fishing party from Paris, with whom we partook of *déjeuner* at small tables in an embowered inn-garden at Pont Rean, didn't find it ugly. They suggested that the name might express mere homely affection, just as the French peasant tenderly calls his wife "my little cabbage."

Photograph by C. A. Slade

A FARMER OF BRITTANY

While the chief calling of the men of Brittany is the sea, the Breton is a successful market gardener in the fertile coast regions.

Photograph by Crété

BRETONS IN HOLIDAY ATTIRE

One of this party, observing a venerable fisherman who sat sound asleep on the river bank, rod in hand, stealthily abstracted from the old man's basket the single fish which it contained and hung it on the hook, which he then dropped back into the water. Presently the fish revived, the old man woke up with a jerk and landed his catch. A moment later he came hurrying into the inn-garden, all excitement.

"Monsieur Michel," he cried, addressing the proprietor, "here is a miracle of a fish! I catch this fine fellow, who when I am asleep jumps out of my basket back into the water, and then gets himself caught a second time. He shall be stuffed, this jumping prodigy, for my collection. Nothing like it was ever heard of along the Vilaine!"

HOSPITALITY ALONG THE ROUTE

During the next five days, spent in traversing the Vilaine's 90 sinuous kilometers which stretch between Rennes and Redon, we passed only lock-keepers' houses, isolated farms, and an occasional cluster of red roofs, where a perfect census of the inhabitants was obtainable by merely counting the rustic fishing-poles which overhung the river's surface.

Throughout those five days the rain

Photograph by Crété

BRETON MUSICIANS OF PONT-AVEN

Pont-Aven is a picturesque little village, formerly much frequented by artists. It has been called "The Millers' Town," because of its many riverside mill-wheels, and also "The famous town with fourteen mills and fifteen houses." Anatole France has written about the gracious young girls of Pont-Aven, with their great white quilled collars, windmill coifs, and black, accordion-pleated skirts. The hats of Breton men are distinctive, being low-crowned and wide-brimmed, with long velvet ribbons hanging down behind.

descended in torrents, while we either donned mackintoshes and pushed ahead or retreated within the snugly curtained center space and let the elements howl.

As for meals, under these conditions, there was always a kindly lock-keeper and his wife who would ask us into their little flag-floored house, where, under some patriotic lithograph depicting Mademoiselle Alsace in the liberating poilu's embrace, we would dine *en famille* on cabbage soup, country cheese, and cider, departing with a huge bouquet of geraniums or chrysanthemums, which the good wife would insist on picking for us from her garden.

The French lock-keeper is sometimes an old soldier, but oftener is some black-clad woman who took up her husband's duties when he was called to the front, and who (for he never came back) will continue them until her little François is grown up—or, as she sometimes sadly puts it, "Until he comes back safe, as I hope, from the *next* war, M'sieu."

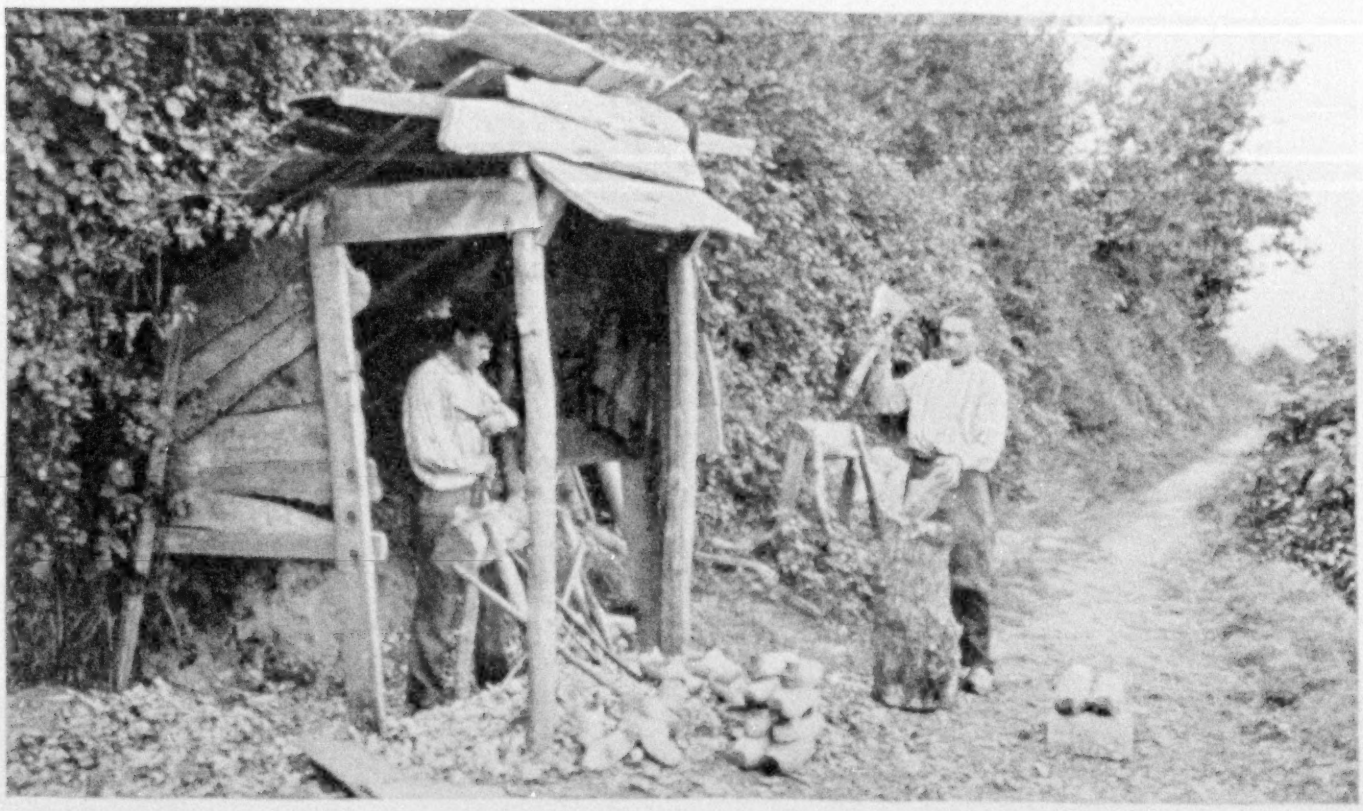
At Redon we were informed that a three days' delay would be necessary, as the lock was undergoing repairs. However, a canoe possesses some advantages over a canal boat; and great was the excitement among the families aboard the waiting flotilla of canal boats when we put the *Nagcoma* on a hand-cart drawn by draft-dogs, transported it around the broken lock, and launched it in the Nantes-à-Brest Canal.

MEMORIES OF AMERICANS WHO ATE "COW FODDER"

Then for five more days we paddled along the 100-kilometer stretch of stream that unfurls itself ribbonlike among rolling, windmill-topped slopes between Redon and Nantes.

We found that the countryside still fondly recalled the passage of American troops in 1918—how they had swum in the canal, and had given the children little packets of chewing-gum, and had strangely delighted in consuming cow-fodder.

This last detail was related to us by



Photograph by Crété

MAKING WOODEN SHOES

a farmer, who added, "Most vigorous young men those, M'sieu! Wonderful teeth, wonderful stomachs! How they could ever digest that stuff was the wonder of the countryside." And he pointed to one of those fine fields of Indian corn which in France are cultivated exclusively as cattle food.

"Why, that's easy!" we confided; "all Americans eat that." And we described the manner of preparing and dispatching an ear of corn. Suddenly a light broke on the listener's face:

"Ah," he exclaimed, "I understand! Then one doesn't eat it, cob and all, like the cow; one just picks at it, as it were an artichoke, *n'est-ce pas?*"

WHERE QUEEN COW COMMUTES

It is indeed a case of Queen Cow in Brittany. Not only are cornfields planted for her, but, as we saw on the Nantes-à Brest, she actually "commutes" across the canal in a flat-bottomed boat, morning and night, to and from the most favorable of grazing grounds.

At Blain a glimpse of the Château de la Barrière warned us that we were quitting *"les petits pays,"* and not long after we issued upon the wide Erdre, with its fine panorama of oak-clad heights, successive châteaux, and riverside tea-gardens, where oarsmen of "sixes" and "eights" were regaling themselves after their dash down from Nantes.

Even in that big town, when we dropped anchor in the barge-crammed canal we hadn't lost the back-doors aspect of things. With our green canvas roof over our heads and the deck of an adjacent barge to cook on, we were fairly in the bosom of homely family life.

These big canal boats, gaily painted with red and green stripes, bearing two enormous wooden rudders, and embellished by geranium gardens atop the cabins, constituted hearth and home for the wives, who sat knitting socks, and the husbands, who were wheezing "Madelon" on mouth-organs, and the half-dozen romping children, and the back-arched cat, with her eye on the bone-gnawing puppy.

The Walrus and Carpenter, the barge on which we cooked our meals, was so named by us because her cargo consisted of "such quantities of sand." Just as Normandy is renowned for its cheese and Marennes for its oysters, so is the Loire for her sand, as innumerable barges and at least one canoe, as you will hear, can bear witness.

FLOATING LAUNDRIES AT NANTES

Another feature of back-doors life was comprised in the twenty-odd enormous wash-barges anchored on each side of the

Photograph by Crété

DECORATING WOODEN SHOES

canal. At Nantes they "wash their dirty linen in public" and on a vast scale. The lower decks of these *bateaux-à-lavoir* contain hot-water boilers and are fitted with broad gunwales, which are used as washrooms. Their upper decks consist of drying-space, for use in wet weather.

The public washerwomen pay the *patron* of the barge one franc apiece daily and prorate the fuel charge. Early each morning they appear with wheelbarrows full of dirty linen. All day long they stand side by side at the gunwale washboard, soaping, rinsing, and beating the linen with their flat paddles (see p. 40).

Toward afternoon the entire canal frontage is white with acre upon acre of drying clothes. And at sunset the finished handiwork is loaded on the barrows and the washerwomen trudge away through the streets, on their respective delivery routes.

Such is the daily routine of the "Washerwomen's Boulevard" — a sight whose magnitude amazes you until you realize that you are beholding the public laundry of 170,000 people.

The traditional temper of the Nantese is epitomized in the local statue of their hero, Cambronne, who, when ordered at Waterloo to surrender, replied contemptuously, "The guard dies, but never surrenders!"

THE NANTESE FOUGHT FIFTEEN HUNDRED YEARS FOR FREEDOM

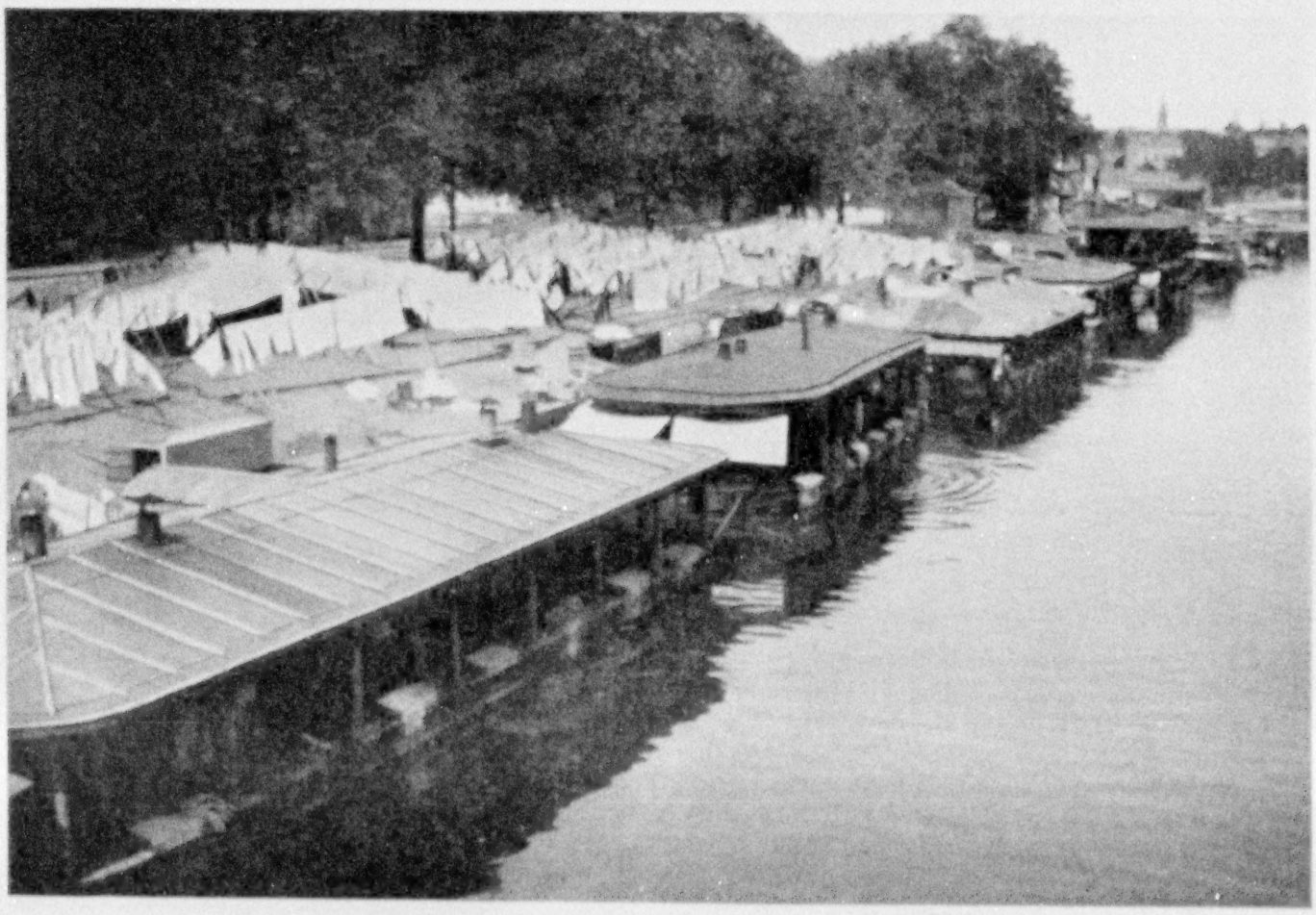
For fifteen hundred years the Nantese strove successively against Roman, Norman, English, and, last, the French for the independence of Brittany. They preferred their secluded dukedom to being under a king of all France; and though they had finally to yield, in 1793 they did their utmost revolutionary bit in the cause of the people.

If anyone wants proof of the fighting spirit of the Breton, let him search out, in the local museum, the tanned skin of a certain unknown soldier. "I won't be able to fight after I'm dead," this hero told his comrade when he fell, mortally wounded, "but at least I'll keep on making a noise in the world. Just you have my hide tanned and made into a drumhead, to put heart into the boys when I'm gone!"

His wish was only half fulfilled; yet let us hope that some war poet of the day made this dauntless warrior's words reverberate in his lines.

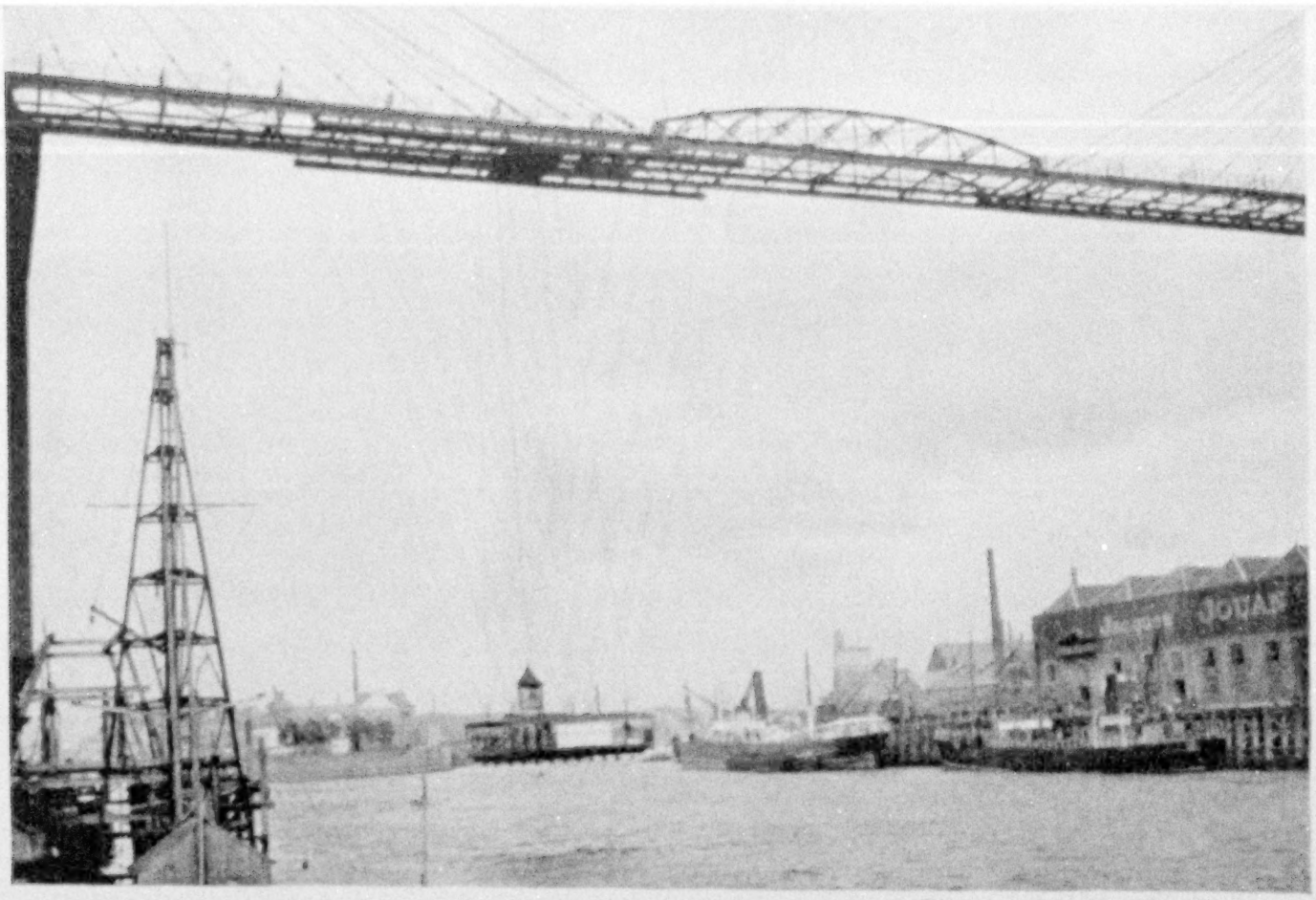
THE "NAGEOMA" PASSING THROUGH A LOCK

France has great reason to be proud of her canal system (see text, page 48). Water traffic is chiefly in heavy merchandise. The system attains its greatest utility in the northern part of the country, and more than 773 million kilometric tons of merchandise are carried annually.



Photographs by Melville Chater

"WASHERWOMEN'S BOULEVARD" AT NANTES (SEE TEXT, PAGE 39)



Photograph by Emil P. Albrecht

A "PONT TRANSBORDEUR," OR FLYING BRIDGE, AT NANTES

The suspended car (lower center of the illustration) moves with perfect rigidity, no motion being felt. Marseille and Rouen also use bridges of this type. Nantes is noted especially for its numerous bridges over the different arms of the Loire and the Erdre. Founded before the Roman conquest, Nantes is to-day a bustling modern city, its port being what one Frenchman calls a "tumultuous vision," made up of forests of masts and smokestacks, sugar and oil refineries, and ship houses.

We left the canal, and, choosing the slack-water hour preceding flood-tide, ascended the Loire toward the château country. Now, I am certain that, in centuries past, when châteaux were military strongholds, they never obstructed navigation on the Loire half so effectively as the river's sand-shoals do to-day. Rightly is the sand of the Loire famous—or infamous, if you choose to regard it from the canoeist's viewpoint.

Though the French glass and cement industries work overtime and the dredges do their best, their united efforts at exhausting the sand of the Loire are about as effective as "seven maids with seven mops" sweeping up a sea-beach. It was hopeless, even for a canoe; so we shipped the *Nagcoma* to the middle Loire, where the châteaux are many and the sand-shoals are fewer.

Langeais, Luynes, Amboise, Chaumont, Blois—outstrung jewels on the river band of the Loire! Yet they are jewels which were fashioned and set on their river-commanding heights at different periods and with different aims. Nevertheless they have an historical bond, since most of them occupy the sites of Roman camps, from which they derive their names.

Langeais is a corrupted form of Alingavia, and Maillé (the older name of Luynes) is but a slight modification of Malleium. But Gallia declined to remain a Roman colony, and by degrees these sites fell into the hands of the early Frenchmen. Thereupon they erected fortresses, and, the Romans being out of the way, proceeded to battle among themselves.

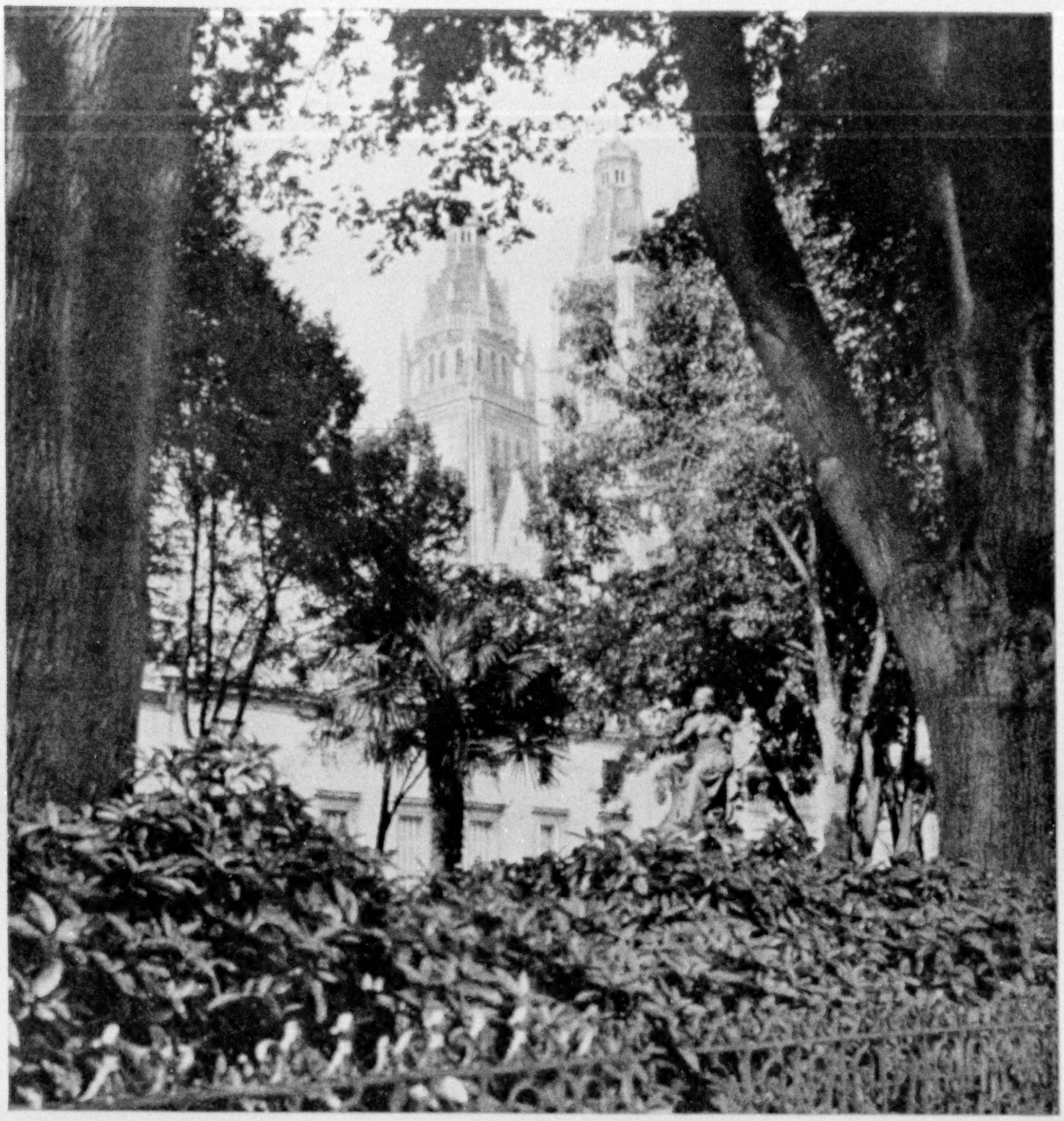
Luynes' grim walls and unornamented towers give us a fair idea of what this military fortress was in the twelfth century, when the powerful nobles warred against each other and even against the king.

Around Langeais centered the great

Photograph by Crété

THE CHURCH OF NOTRE DAME: ANGERS

"Black Angers," home of the Plantagenets, occupies rising ground on both banks of the Maine. It underwent an almost complete transformation in the 19th century, its ancient ramparts being replaced by boulevards and numerous large edifices constructed. The noted sculptor, David, was a native of Angers. The region surrounding the city is famed for its nurseries and market gardens.



Photograph by Emil P. Albrecht

SQUARE ÉMILE ZOLA AND THE CATHEDRAL TOWERS OF TOURS

The Cathedral of Tours was begun in 1225 and was dedicated to St. Gatien, who introduced Christianity into Touraine. Honoré de Balzac, who was born in Tours in 1799, has described the city and the surrounding country in several of his novels.

battles between the counts of Anjou and the barons of Touraine. From behind its walls Richard of England (who was also a count of Anjou) defied the crown, and for centuries the English continued to use the castle as a base for gentlemanly brigandage, until the unhappy neighborhood bought them off with 2,000 gold crowns, stipulating that the fortress be destroyed.

Thereafter hard-fisted Louis XI, having quelled his unruly vassals and unified France, rebuilt for himself a modified Langeais—the castle as it stands to-day. He wished to create an amicable impression among the Tourainians by having, not exactly a fortress, but a royal residence, in their country. And so he erected a crafty combination of ornament and bulwark—say, 25 per cent residence and 75 per cent fortress.

MILITARY STRONGHOLDS LOST THEIR AUSTERE ASPECT

Amboise and Chaumont belong to the same century as Langeais and show the same tendencies. They are military

Photograph by Crété

OLD SEA WOLVES AT A BRETON SEAPORT

strongholds, softening under ornamentation of pinnacle and carving toward a purpose which became always less warlike and always more luxurious.

Of this gradual transition the final stage is seen in the châteaux of Blois and Azay-le-Rideau, where not a ghost of the somber feudal fortress remains; where windows, and not loopholes, look out upon parks instead of drawbridges, and where ornament expands into the embroideries of a pleasure palace in which the rustle of silks has replaced the clang of mail.

Blois is for the traveler who prefers to hobnob with the ghosts of gorgeous cardinals and queens and satin-doubleted courtiers.

But whoso would conjure up visored knights, and the whizz of crossbow-bolts, and the thing called feudalism, let him visit hill-perched Luynes, its four grim turrets frowning down upon the tiny, nestling village which of old contributed its tithes and pikesmen, and whose house fronts still bear the carven saints who for centuries have witnessed the tramp of troops on their way to war.

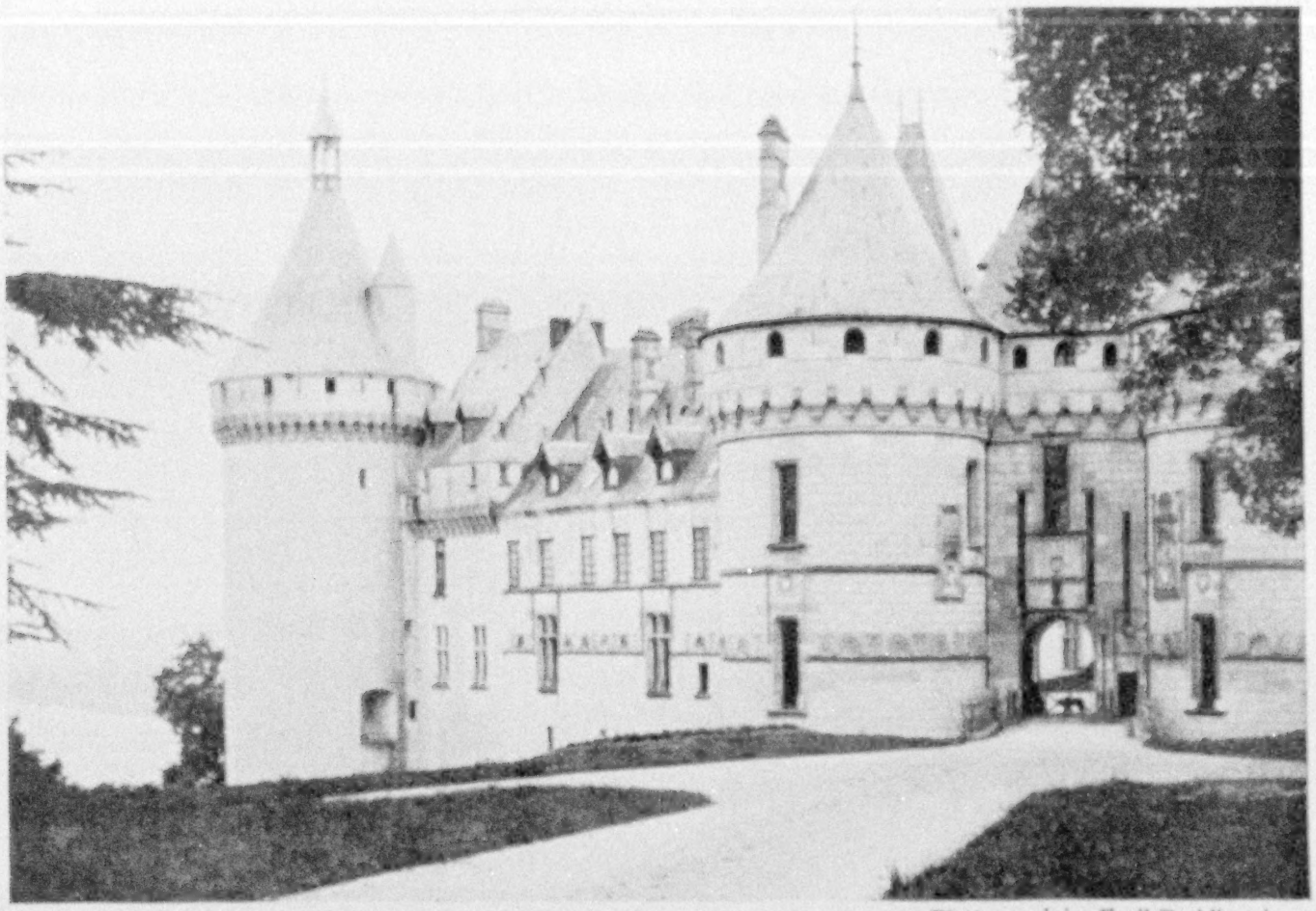
At Luynes we discovered a very humble inn where the defects in the cuisine

MUX

Photograph by E. M. Newman

THE CHÂTEAU AT AMBOISE, ON THE LEFT BANK OF THE LOIRE

Amboise has been called "a little, white-faced town, staring across an admirable bridge and leaning . . . against the pedestal of rock on which the dark castle masses itself." It was here that the young Mary, Queen of Scots, spent some time after her first marriage. Here, also, tradition says that in 1560 Catherine de Medici forced her to witness from a balcony the wholesale *noyades*, or drownings, of captured Huguenots in the Loire. Both Amboise and Tours lie in a region rich in vineyards, and known as the Garden of France.



Photograph by Emil P. Albrecht

THE 15TH CENTURY CHÂTEAU DE CHAUMONT, NEAR BLOIS

Built on the site of a castle of the 10th century, by Pierre d'Amboise and his son Charles, this impressive pile of masonry sits proudly above the Loire, flanked by the trees of its great park. It belonged once to Catherine de Medici, to Diana of Poitiers, and, in the time of Napoleon, gave shelter to Mme. de Staël. It is now private property, containing an interesting historical museum, which is open at stated intervals to visitors.

were almost compensated for by the genius of its sole waiter. He was a marvelously cheery little man who encouraged us by sniffing distantly, and with rapt, half-closed eyes, at the alleged aroma of the poorest of pinkish wines. When the establishment served bread-and-water soup three times running, he anticipated our flagging enthusiasm by announcing it successively as *"Soupe Grand'mère," "Potage Grand-père,"* and *"Soupe Bonne Femme."* And when it appeared for the fourth time, he hastily dropped a boiled onion into it, exclaiming with a touch of grandeur, *"Voici, monsieur et madame—Purée au Millionnaire Américain!"*

ENCOUNTERING A FAMOUS CHEF

At Orléans we regained the canal, with 125 kilometers to go before reaching the Seine. It was pleasant to return to the back-doors country, where our friends the lock-keepers always smiled a welcome, and where between locks long silences reigned and living landscape merged so perfectly with watery reflection that the vista might have been turned upside down without our perceiving the difference.

We were passing the limits of château-land, and our last glimpse of riverside turrets revealed the final lapse of baronial dignity—a sixteenth century château, now dwindled into a peasant's farmhouse.

Our stores were running low and canned-goods rations were beginning to stir us with certain cravings to arrive at Paris, when one evening we sighted the village of Grignon. On the bank stood a dubious-looking inn of the kind where cabbage soup is the main dish and where your bill is brought to you chalked on a slate. Nevertheless, we entered and announced unemotionally that, whatever was to be had, we would dine on it.

Thereupon clatterings commenced in the kitchen, and an uncle of the family

Photograph by Emil P. Albrecht

ENTRANCE TO THE CHÂTEAU OF BLOIS

The façade of the wing of Louis XII was built, in 1498-1503, of small black and red bricks. The ornamental entrance gate has a Flamboyant niche, with a modern equestrian statue of Louis XII, second husband of Anne of Brittany. His emblem, the hedgehog, surmounted by a crown, can be seen above the great arch and the small door.

appeared and we fell into conversation with him. It turned out that he was someone's chef on a vacation. He had cooked, cooked, cooked, he said sullenly, and never, never did he want to look on a gridiron again; he was here to forget all that.

Upon learning that we were Americans, he beamed unexpectedly, then left the room. Five minutes later we heard his voice scornfully upraised in the kitchen: "Imbeciles! Farm hands! What do you know about the culinary art? There, let me do it!"

Photograph by Emil P. Albrecht

THE CATHEDRAL OF SAINTE CROIX: ORLÉANS

This structure displays a last lingering phase of Gothic architecture. Begun in 1287, it was destroyed by the Huguenots in 1567, but rebuilt in the period between 1601 and 1829. The towers are 285 feet high, and terminate in crown-shaped galleries. The central spire rises 325 feet. The adjacent theater was once the Church of Saint Michel.

And he did it. How he conjured that delicious meal out of Grignon's slim resources remains a mystery. But later, when he appeared in snowy cap and apron to receive our congratulations, part of the mystery was solved.

"Monsieur and madame," he admitted, smiling, "I am—I have the honor of being chef to the American Ambassador at Paris!"

At Buges, where the Orléans, Briare, and Loing canals intersect, we locked through into the last named and were soon amid the press of a canal-boat traffic which increased hourly.

The locks in the back-doors country are built to accommodate one boat at a time, and boat fits lock with a skin-tight nicety, its passage through resembling somewhat the drawing on and pulling off of a glove.

"TRACTION PERFORMED BY HORSES, ASSES, AND MEN"

Often between Buges and the Seine we beheld the odd sight of a man with the tow-rope hitched about his middle, dragging along some ponderous barge, mile after mile, while he smoked his pipe and read the morning newspaper. As the *Guide Officiel* naïvely puts it, "On the Loing the traction is performed by horses, asses, and men."

The French canal system dates back to 1638, when the Canal de Briare was constructed. Since then it has swelled into a vast complexity of routes which total more than 3,000 miles of canals and nearly 7,000 miles of navigable rivers, canalized and noncanalized.

It is no exaggeration to say that traffic may be moved from any one to any other part of France over this remarkable system, which entails an annual upkeep expenditure of 30,000,000 francs. Its longest link is the Canal du Midi, which extends 380 miles across southern France, connecting the Rhône with the Atlantic Ocean.

The maximum of traffic is found on the Marne-au-Rhin Canal, which in 1919 carried 110 million K. T., or kilometric

Photograph by Topical Press Agency

THE STATUE OF JOAN OF ARC IN THE PLACE DU MARTROI, ORLÉANS

Orléans shares with Rouen the chief honors of association with the Maid of France. She is described as the "Victrix Anglorum" on a memorial tablet in the cathedral, and the town is full of monuments to her memory. The anniversary of the Maid's raising of the siege of Orléans, in 1429, is usually celebrated with great pomp.

tons. A K. T. is one ton which has been transported one kilometer. Multiplying thus the tonnage carried by the distance it moved, we find in the same year a grand total of 773 million K. T. as the canal traffic of all France.

STORIES THAT NEED A DE MAUPASSANT TO RECORD THEM

An entire article might be written on the canal boatman and his gregarious life among the beautiful back-doors countries of France. He is a kind of water-gipsy, and nothing can woo him to conventional housekeeping in big towns. The very names of canal boats form an interesting study. In the heart of Brittany, for example, you find religion and sentiment predominating, as in such names as *"Good St. Médard," "The Young Marie,"* and *"The Beautiful Lucie."* As you near Paris, you glimpse such materialistic appellations as *"Big Business"* and such frankly cynical ones as *"The Hope (?) of Love."*

And the human stories—lost for want of a de Maupassant!

One night, as we sat in a wretched canal-side inn at Nemours, there entered an old, horrible, toothless wreck of an Alsatian, who obviously had disregarded the inevitable placard which in such resorts proclaims against public drunkenness.

The proprietor knew what he wanted and, without being asked, turned on a mechanical piano, to whose strident strains the old man began solemnly waltzing about the deserted café, his arms inclosing some imaginary partner. After three waltzes and as many brandies, he fell into a chair by us and said:

"Ain't I an old sight, though? Would any of the girls in the big café opposite dance with the likes of me? Ah! but once I was a spry youngster, and whenever my canal boat touched at Nemours I used to waltz in this very room with the *patron's* daughter, Leonie. Yes, and I named my boat *La Jeune Léonie;* and

Official photograph, U. S. Army Air Service

"MONSIEUR, THIS IS PARIS"

Looking across the Place de la Concorde toward the imposing colonnaded Madeleine. The bridge in the foreground is the Pont de la Concorde.

when a barge skipper does that, you know what it means.

"But I didn't pass here but once in six months, and when I dropped in one day she was gone—had married a baker at St. Mammès.

"Well, I renamed my boat the *Who Cares*. And when a man does *that*, you know what it means. Oh, yes, I married, and had a fine, big family, and renamed my boat *The Good Wife*. But they all died or left me, and my boat went up the backwater, as we say when a barge skipper has to sell out, and now I'm just an old, toothless donkey-driver on the canal path.

"But still, whenever our barge touches Nemours, I drop in here at the old place. Maybe my boat 'll come down the backwater some day; and if she does," and he vowed it to heaven with a vinous smile, "she shall be called *La Jeune Léonie!*"

Twenty kilometers beyond Nemours we passed the last lock of the back-doors country and floated out upon the Seine—noble curves winding between magnifi-

cently wooded heights which sloped downward into level swards, where white villas gleamed among overarching trees.

But there were still locks ahead—nine big ones, each capable of holding 16 barges at a time, and necessitating a delay of from half an hour to an hour, depending upon whether we locked through alone or in company with a full quota.

Racing a string of steam-towed canal boats is really more exciting than it sounds. Though we could pass them readily enough, our object was to lock through before the far-off tug whistle warned the keepers of the flotilla's approach, when we would be detained for its arrival.

Sometimes the *Nageoma* won and locked through alone, looking like a peanut in a swimming-bath. Sometimes we lost and locked through in company with 16 big barges. At Vives Eaux, where it was the latter case, the final boat had just entered the lock when the keepers discovered that the sluice mechanism was broken. It would entail, they announced, a 24-hours' delay.

"GOOD LUCK, SHRIMP AMÉRICAINE"

Now, we didn't relish the prospect of lying overnight in that cement tank. As for the bargees, they gesticulated, and cursed, and upbraided the lock-keepers with a violence which boded the drawing of clasp knives.

In a lucky moment one rough fellow discovered the *Nageoma* lying wedged in among the canal boats and looking like a minnow among a school of whales. He fairly gaped, then yelled to his comrades:

"Hi, you! Here's a shrimp that's got caught in the lobster-pot!" and immediately we became the center of the picture.

All bad humor fled, and every man lent a willing hand to extricate the "shrimp" which had crossed France from St. Malo. A couple of ropes, 20 stout arms, an "All together, boys!" and the *Nageoma*, baggage and all, was hoisted from the lock and relaunched in free waters.

"Au 'voir!" yelled the grinning bargees, waving after us, "Good luck, shrimp *Américaine!*"

Two more days on the glassiest and fairest of ever-widening waters, while the red roofs of Corbeil and Villeneuve-Saint-Georges slipped past, while noble, tree-crowned heights embraced us, and racing shells darted by, and Sunday parties sat at luncheon in rustic arbors perched among the limbs of waterside trees.

Then the Paris-Lyons-Mediterranean Express thundered overhead, across the stream, and we waved our good-byes to the back-doors country.

Ahead the sky grew murky, where cranes and factory chimneys towered; then certain distant murmurings deepened into a dull roar, as successive industrial suburbs came into view. And finally stone embankments arose on either hand, completely cutting off the prospect.

Wishing to know exactly what suburb we had reached, I ascended a convenient stairway and addressed myself to a man who was leaning over the parapet.

"What town is this?" I asked casually. But he didn't falter or ask me what my barbarous race was. He merely pointed over my shoulder, and I turned and saw it all—the vista of arching bridges, the long, tree-bordered boulevards, and afar off, gray and brooding, the square towers of Notre Dame.

"Monsieur," said the Frenchman, with a polite bow, "this is Paris."

Notice of change of address of your GEOGRAPHIC MAGAZINE *should be received in the office of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your September number, the Society should be notified of your new address not later than August first.*

Photograph from Charles Buxton Going

A SOLITARY MEGALITHIC MONUMENT NEAR PENMARCH, BRITTANY

These menhirs (men = long, hir = stone) are of granite from near-by quarries and were erected no one knows how, though some investigators believe that the lever and the inclined plane were employed. Archeologists have suggested that probably the blocks were weathered out from the underlying beds of rock by the elements and needed little quarrying.

THE MYSTERIOUS PREHISTORIC MONUMENTS OF BRITTANY

By Charles Buxton Going

EVEN in a continent rich to repletion with interest, Brittany is remarkable for the multiplicity of its appeal. One traveler may be engrossed in its ethnology; another is delighted by its architecture; a third is charmed with its medieval picturesqueness and quaint costumes; a fourth shuts himself up to dream over its history and romance, while a fifth satisfies his soul to the full with its eminent paintability.

In any of these seductions, of course, the province may be matched or outmatched by other countries; but it stands unrivaled as the land of those strange megaliths—the *grandes pierres* or *monuments celtiques*—in which a prehistoric race, a people apparently of considerable civilization and intense religious feeling, seem to have striven titanically toward self-expression and to have left, after all, a great but almost unintelligible cry.

That, perhaps, is the enduring emotion left with the visitor to the giant dolmens and the vast alignments of Morbihan. These were the work of men agonizing to the end that they and their dead should never be forgotten. And yet, who were they, and what is it they have tried so hard to say?

THEY LEFT NO WRITTEN RECORDS

Assyria, chronologically still more remote from our era, is as an open book through the almost miraculous recovery of the key to the cuneiform inscriptions; but these herculean toilers of western Europe, transporting and raising their huge boulder monuments on the wild Breton moors, seem mere shadows in the mist, unable, because they left no written language, to speak to us across the centuries.

And yet, through patience in investigation and skill in interpretation amounting to genius, a few eager workers, especially the little group connected with the Musée Miln, at Carnac (50 miles west of Redon, see map, page 3), have begun to explain these monument-builders to us; to draw, indeed, clear outlines of their origin and aspirations, even to sketch something of their social order.

Nowhere in the world could a specialist have found greater wealth of this peculiar archeologic material than lay around M. Zacharie Le Rouzic and the man to whom he affectionately refers as his "regretted master, Mr. J. Miln," in Morbihan and Finistère.

Almost every commune in Brittany has one or two Celtic monuments—indeed, they are found, sometimes in very fine examples, throughout western France. But grouped about Carnac, within a radius of seven miles, there are nearly 300, even counting the hundreds of menhirs in each of the great alignments as a single unit.

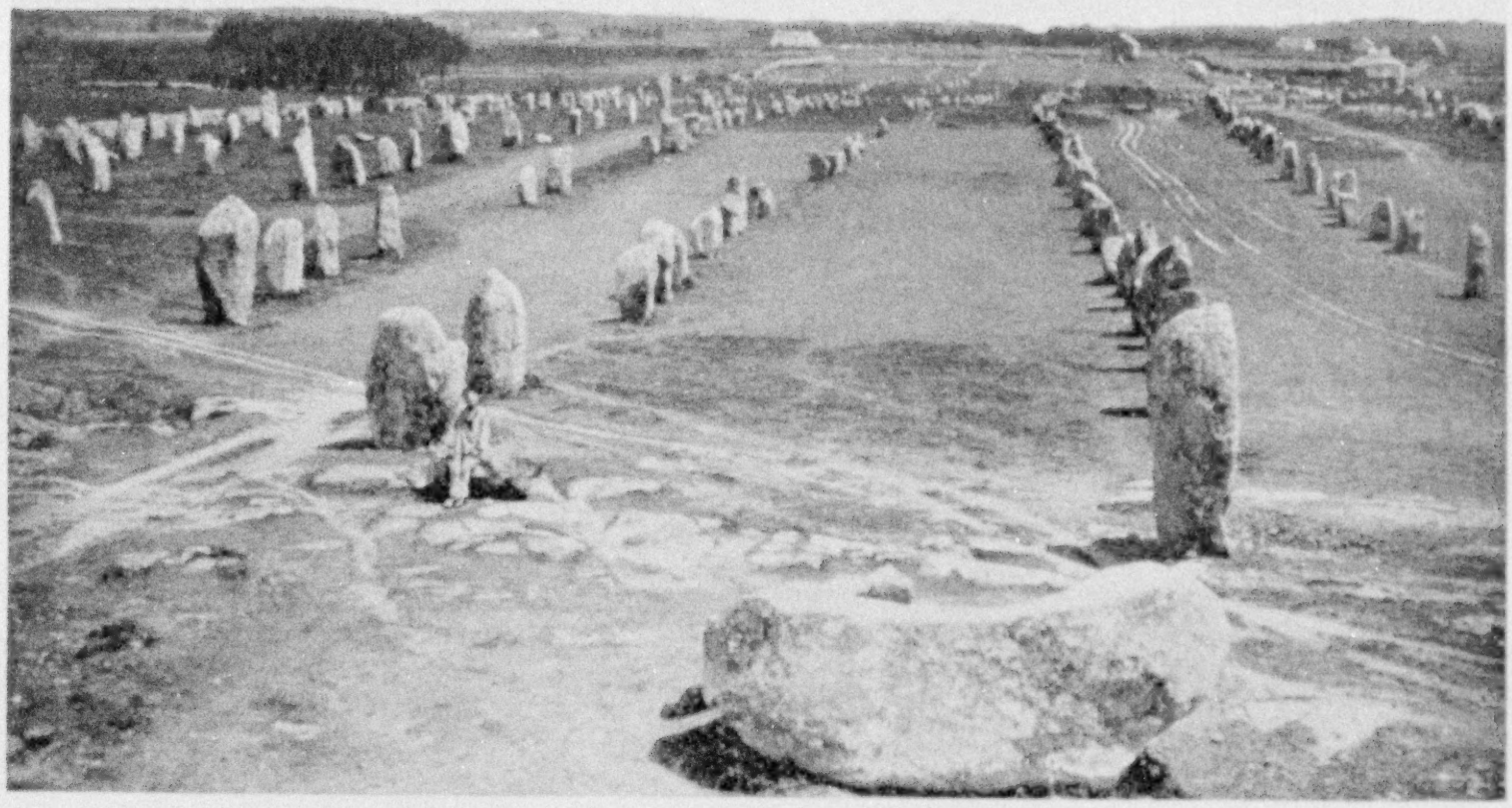
Miln's results, gathered in the museum bearing his name, have been and are still being continuously extended and enriched by his successor, and the following summary is based largely on their deductions.

A PLACE OF PILGRIMAGE AND RELIGIOUS CEREMONIES

This region, it appears, was a sort of Mecca, or peculiarly holy ground, to which the remains of heroes and leaders were brought for entombment, to which the faithful flocked in pilgrimages, and in which the great religious ceremonies were held.

Carnac was probably to the western continent of Europe what Stonehenge was to the British Isles. There is at that place, in fact, a focus and concentration of the megalithic works left by the Celtic forerunners in their prehistoric migration which, starting in Asia, moved across northern Africa, over Mediterranean waters, into Spain, and along the shores of the Atlantic, constantly striving westward to find the resting place of their god, the sun, but ever baffled by the impassable ocean, and so forced northward, until the effort died out in Scandinavia.

In their long sojourn near these shores, covering at least 2,000 years, they became increasingly an agricultural people. The weapons and implements placed in the



GROUPS OF MEGALITHS AT CARNAC, THE STONEHENGE OF BRITTANY (SEE TEXT, P. 53)

There are traces of these alignments of stones extending for a total length of nearly five miles. They are in 10, 11, or 13 parallel lines, spreading over a width of 330 to 450 feet. Many of the stones have fallen and been removed by the natives for building use, but nearly 3,000 remain.

sepulchers lose their rough but serviceable character and appear in polished but merely votive forms, often in soft or valuable stone. A few attempts at carving (as in the dolmen of the Table of the Merchants and the tumulus of Mané-er-H'roeck, at Locmariaquer) have satisfied the most careful investigators that some use, at least, of iron—or, at all events, of metal—had begun.

AGRICULTURE EXALTED TO FIRST PLACE

Further, these carvings are best interpreted as representations of agricultural symbols—an ox, a "hatchet-plow," the sun vivifying ears of grain—thus confirming the belief that cultivation of the soil had been exalted to first place.

Ultimately, having lost their military hardihood and having been deterred (perhaps by resistance on the part of the priesthood) from advancing in the use of metals, these stone-users were overrun by bronze-sworded Gallic invaders, and these in turn by the steel-weaponed warriors of Rome.

Each superimposed culture, however, seized upon and adopted, or adapted, some parts at least of the preëxisting beliefs and institutions of the land, and especially its holy places.

The worship of stones (perhaps as symbolizing eternal existence) seems to have continued indefinitely, as witnessed by various edicts of the early Church condemning the practice. A Jesuit writer speaks of it as persisting at the end of the 16th century, and it is indeed represented

Photograph from Charles Buxton Going

LONG FILES OF MONUMENTS ARRANGED WITH MILITARY PRECISION

Legend says that these menhirs were pagan soldiers pursuing Saint Cornély. He, finding further flight cut off by the sea, turned them into stone. Once a year, on Christmas, at midnight, they leave their stations to drink at the streams. Many of the country folk believe that calamity would overtake any who watched for the miracle.

at the present time by superstitions concerning the stone monuments inextricably mingled with the religion of the Breton peasant of to-day, whose chapels and great ceremonial fairs, moreover, are almost always closely associated with the sites of the chief megaliths.

THE SIZE AND TYPES OF MONUMENTS

Nine types and several subtypes of these monuments have been defined, of which the most important are: the menhir, or "long stones" set on end; the dolmen, or houselike structures, with stone slabs or boulders for walls and roof; and the tumulus, or mound. Alignments are groups of menhirs arranged in line or in several parallel lines. Cromlechs are groups of menhirs standing in a circle or an arc of a circle, more rarely a square, usually terminating an alignment or surrounding a tumulus. The dimensions are sometimes incredible.

The Great Menhir near Locmariaquer, now thrown down and broken (probably by an earthquake), was nearly 70 feet high and weighed some 375 tons.

Some of the dolmens have a height of 18 to 20 feet, with roof slabs 20 by 35 feet in area and several feet thick. Baring-Gould indeed mentions one near Névez (Finistère) "whose capstone measures 45 feet in length and 27 feet in breadth and 6 feet thick."

The alignments of Carnac, in 10 to 13 parallel rows, stretch across the country for nearly five miles. The tumulus of Mont St. Michel looks like a natural

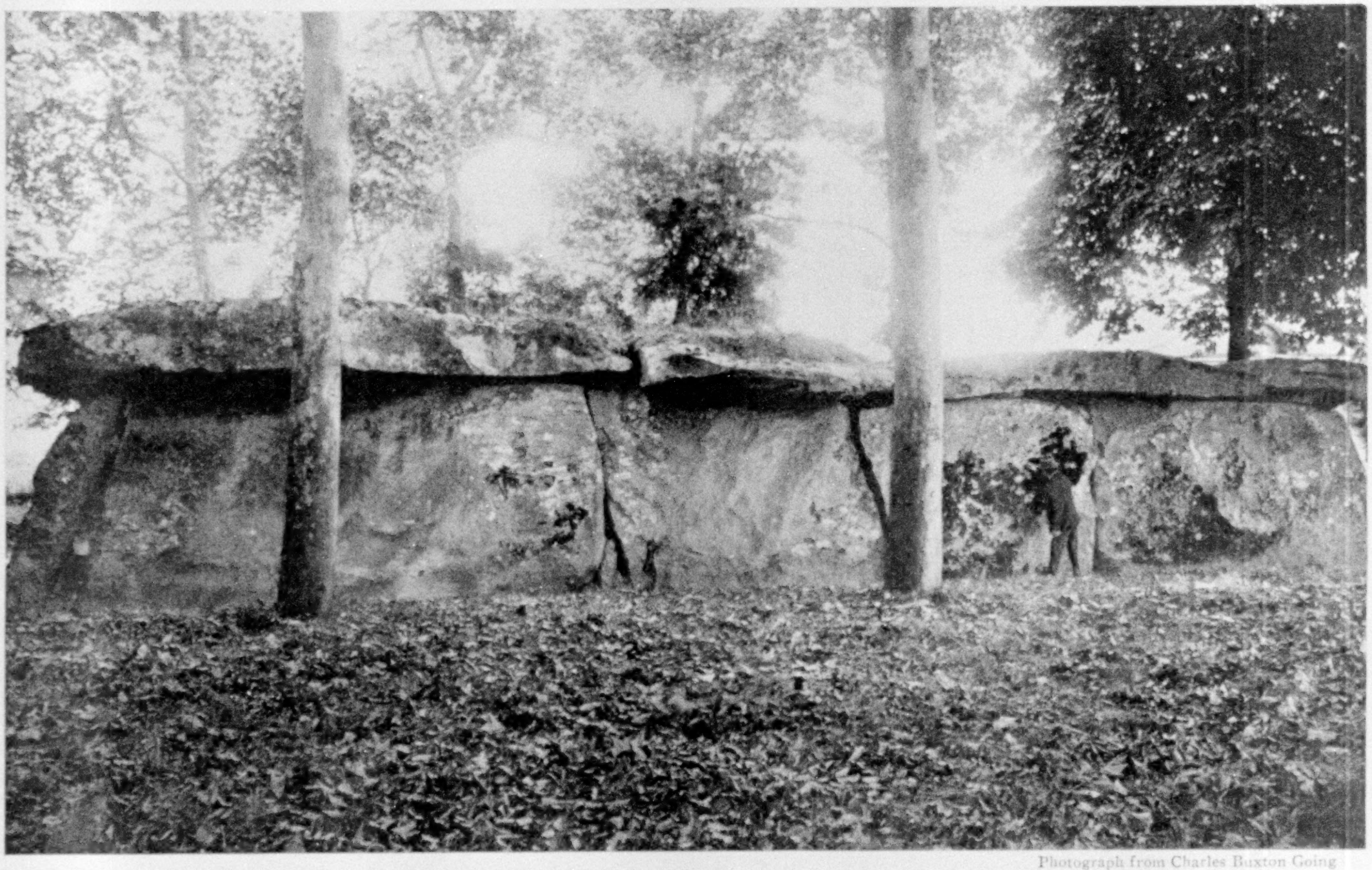
Photograph by Emil P. Albrecht

THE TABLE OF THE MERCHANTS AT LOCMARIAQUER, MORBIHAN

This great dolmen (dol = table, men = stone), which once included the two broken pieces on the right, is celebrated for its grace and the lightness of its points of support. The conical menhir at the left-hand end is covered with indecipherable inscriptions and has something of the appearance of an altar. The table on its supporting stones forms an "allée couverte," in which one may readily walk.

MDX

THE KERVERESSE DOLMEN AT LOCMARIAQUER (SEE TEXT, PAGE 55)

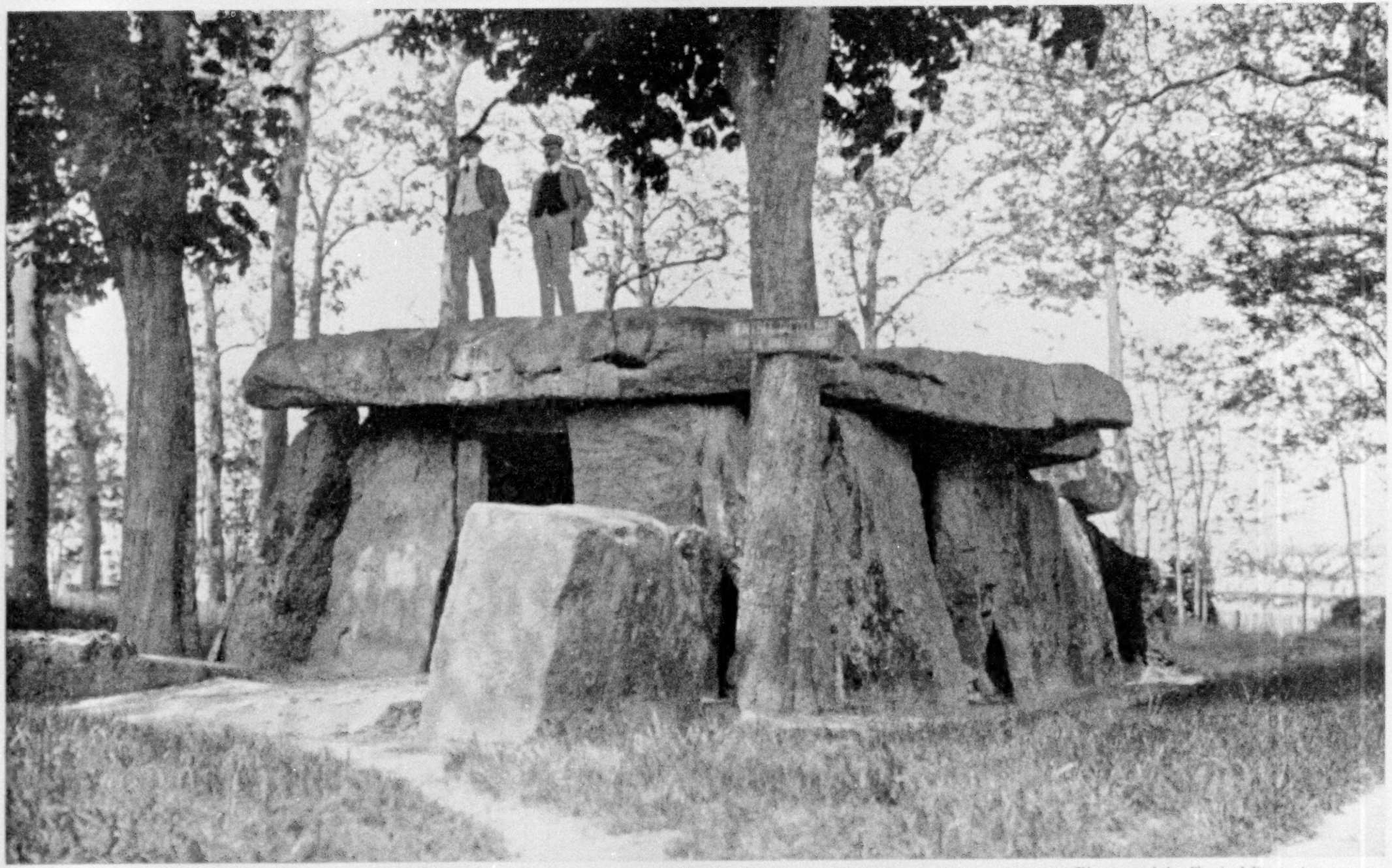


Photograph from Charles Buxton Going

A PORTION OF THE "COVERED ALLEY" AT BAGNEUX

All such remains are supposed to have been crypts, covered by tumuli which have since disappeared. This fine example at Bagneux, to the southeast of Brittany, is one of the largest dolmens (houselike structures) in existence, being 65 feet long, 22 feet wide, with an average height of 9 feet. It is composed of 16 vertical and 4 horizontal stones.

XUM



Photograph by Topical Press Agency

ANOTHER VIEW OF BAGNEUX'S FAMOUS DOLMEN (SEE ALSO PAGE 58)

It has been surmised that some of the dolmens were shrines to which prehistoric men resorted to consult the spirits of their ancestors. The idea has also been advanced that probably the priests of these oracles lived inside the dolmens.

THE KERDERG GIANT AT CARNAC

The parallel rows of menhirs at Carnac have a general east and west alignment and probably terminated in cromlechs—groups of stones standing in an arc or circle (see also illustrations on pages 54 and 55).

Photograph from Charles Buxton Going

THE GIANT MENHIR OF KERZERHO, IN THE ALIGNMENTS OF ERDEVEN

There are 1,030 menhirs in the lines of Erdeven. Their entire length is 5,700 feet and they are similar in many respects to the alignments at Carnac (see pages 54 and 55), but on a smaller scale and of smaller stones.

Photograph from Charles Buxton Going

PART OF THE ALIGNMENTS OF KERMARIO NEAR CARNAC

The great monuments of Carnac consist of three large groups or phalanxes of stones. The country folk of this community believe that unless they prepare a special kind of food and place it upon the tables of the dolmens their crops will be blighted.

XUM

Photograph by Crété

THE "CAUSEURS," OR TALKING MENHIRS ON THE ÎLE DE SEIN

This island was once the seat of a Druid sanctuary and oracle. Here tradition says nine damsels, to whom was entrusted a sacred vase, gathered potent herbs, mixed them with sea foam, and boiled them for a year and a day. Three drops of the decoction, which was kept in the vase, when placed upon the lips of the druidic bard, enabled him to behold the future.

A PASSAGE COVERED WITH FLAT STONES AT LOCMARIAQUER (SEE ALSO PAGES 56 AND 57)

Usually these covered passageways terminated in a small chamber or group of chambers, made by partitioning off the end of the passage and using one or more menhirs as supports in order that there might be no definite line of distinction between the dolmen and the alley leading to it. The dolmen was probably used as a sepulcher for the remains of a chief of a line of rulers (see pages 67-68). The openings to the passageways invariably were placed so that they lay between the points of the rising and the setting of the sun at the summer solstice.

XUM

Photograph by Crété

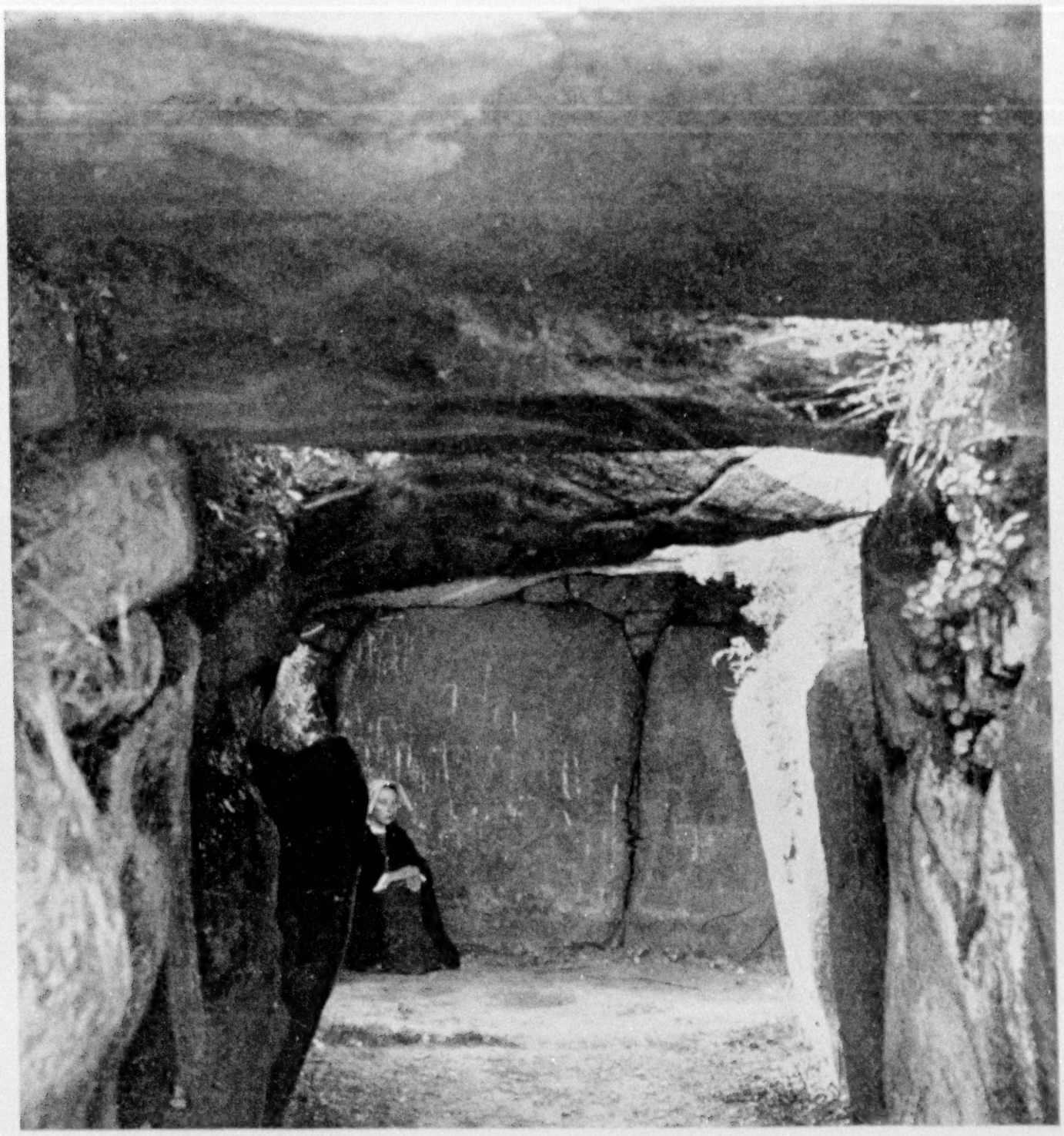
A CABBAGE PATCH IN THE SHADOW OF THE DOLMENS OF KÉRIAVAL, NEAR CARNAC

Some of the stones in the great monuments have tumbled down and have been used to build houses and walls. The little church of St. Cornély at Carnac is built entirely of these stones broken into blocks of convenient size, the crown of its west portal being carved from a single menhir.

Photograph from Charles Buxton Going

TWO OF THE GIANT PREHISTORIC MONUMENTS AT ERDEVEN

The stones at Erdeven are arranged about a circular hillock, which is probably artificial in part, surmounted by two dolmens. Along the southern and western sides of the mound the stones are so small and irregular as not to attract much attention; to the east, however, they become very imposing, some of them measuring from 20 to 23 feet in height, though the general average is from 12 to 16 feet.



PART OF THE PREHISTORIC BURIAL GROUNDS WHICH ONCE STRETCHED FOR MORE THAN 15 MILES FROM LOCMARIAQUER TO CARNAC, ERDEVEN, AND BELZ

The names of many of the local places were derived from the funeral ceremonies which took place within the shrines: Plouharnel means Place of Ossuaries, or House of Bones; Kermario, Place of the Dead; and Kerlescan, Place of Ashes.

knoll, dwarfing the modern chapel which crowns it. It is hard to realize that it was heaped by human hands.

All menhirs, cromlechs, and alignments were from their beginning open to the sky. Dolmens and similar constructions were all originally covered by tumuli, since removed, in many cases, in the course of farming or building operations.

The tumuli were indeed simply tombs, of which the dolmens and "covered alleys" were the crypts. In some the great quantity of skeletal remains, earth-buried or incinerated, would indicate collective sepulture. In other cases, the greater or central dolmen has been found surrounded by smaller dolmens or stone coffers containing the bones of animals and human beings, the latter probably slaves or servitors, all slain to accompany their master into another world, indicating a definite belief in a future life. With these have been found stone implements (celts or hatchets), arrow points,

SENTINELS FOR MANY CENTURIES ON THE BRETON COAST NEAR CARNAC

Various solutions have been offered for the puzzling "why" of these giant megaliths. Those of Brittany are not unique; dolmens have been found in Japan, Korea, Palestine, Algeria, Sardinia, Corsica, Italy, Spain, Portugal, Great Britain, Ireland, Holland, Germany, Scandinavia, and Malta. For a detailed view of the central menhir, see page 61.

and tools of various kinds, fragments of pottery, pendants and beads of turquoise and other semiprecious stones, and amulets of baked clay.

Isolated menhirs have yielded little or nothing indicative of use as monuments for individual tombs. They seem to have been generally commemorative, indicators of roads and territorial boundaries, and "symbolic of an immortal god."

The alignments, on the other hand, appear to have been designed as open-air temples, each group (with its cromlech, placed always at the western end of the lines) having been erected on a single comprehensive plan and at one time. They are the remains of huge religious monuments, the alleys between the parallel files of stones being the aisles in which the devotees gathered and moved, and the cromlech the holy of holies in which the priests performed their rites.

They have a curious general characteristic in that the tallest menhirs are always placed nearest the cromlech, the lines diminishing in height from west to east.

THE MENHIRS SERVED AS AGRICULTURAL CALENDARS

Most interesting of all, however, is an apparently definite scheme of orientation, which tends to prove that, in addition to their ritual use, or perhaps as part of it, these impressive files of monoliths served a peculiar purpose. MM. Henri de Cleuziou and F. Gaillard have pointed out that in each group of alignments will be found a single very large menhir—the "giant" of the group—so placed in one of the outer files that if one stands at a given point in the cromlech he will see the sun rise over the giant at a specific date in the astronomical year.

Captain M. A. Devoir, of the French navy, confirms these observations with greater particularity. "The alignments of Menec and Kerlescan," he says, "give the equinoctial line, while Kermario and Petit Menec give the line of the summer solstitial sunrise and the winter solstitial sunset. . . . Sainte Barbe and Quiberon . . . correspond to the sunrise point midway between the equinox and the winter solstice; Erdeven marks out the intermediate point for the summer solstice. . . . These alignments correspond generally with the following dates: November 8, February 4, May 6, August 8, which are simply the mean dates of the principal agricultural seasons.

"The beginning of November is the time for seeding the crop, which will sprout in February. Blossoming begins in May, and harvest in the first days of August. Thus the Neolithic calendar might regulate the work of the fields, and we know that these Asiatic invaders were agriculturists."

The orientation, be it understood, is not exact at the present date. Calculations made independently by two astronomers reach the same result—that it was correct at a period about 1,600 years before the beginning of the Christian Era. This curious testimony to the age of the monuments agrees with conclusions reached on other grounds by M. Le Rouzic, placing only the earliest of the megalithic structures prior to 2000 B. C.; the greatest development of dolmen-building and the erection of the alignments and cromlechs between 2000 B. C. and 400 B. C., and the latest work, expressed by small galleries and stone coffers, in the first century before the Christian Era.

Local superstition invests the whole region with curious wild beliefs and legends strikingly like the Celtic traditions and folk tales of Ireland and Wales. Lights gleam and flicker among the ghostly stones after nightfall. Strange sounds are heard among them and weird voices cry across the dark. One may meet spectral animals crossing bridge or ford, and escape them only by hastening past the nearest roadside cross!

Many an old man and ancient dame of the passing generation has contributed such items, from veriest personal knowledge, to enrich the "Legends and Traditions of Carnac."

Their belief is implicit. Mystery and magic are the most certain things in life. The great stone monuments have no perplexities for such minds. The dolmens, everyone knows, were the habitations of the Kerions, or Korrigans, a race of very small but very strong dwarfs who formerly peopled the land.

Does not one still say "as strong as a Kerion"? They come back to lodge in their old homes and to dance round about. Woe to him who troubles them! He will die swiftly and surely. As for the alignments, here is the simple tale of their origin:

"In those days Monsieur Saint Cornély was traveling about the world in an ox-cart, and it was he who carried the blessing of God everywhere. But the heathen soldiers wished to kill him and they pursued him. But Monsieur Saint Cornély arrived at Carnac just at that time. 'It is here that I will stop,' he said; 'it is here that I will dwell.' Then he hid in the ear of an ox, and he changed into stone all the soldiers who were pursuing him.

"That is why one sees the long files of stones standing to the north of the town of Carnac, and why often in the night specters walk down these alleys, called 'soudardet san Cornély'—Soldiers of Saint Cornély."

XUM

THE "TECATE" IN A SHELTERED COVE AMONG THE SAN BENITO ISLANDS

The Fisheries patrol motor ship *Tecate* was placed at the disposal of the expedition to the desert islands off the coast of Lower California by the Mexican Government, which met the expenses of the party while in the field. The party visited and collected specimens from the islands of Guadalupe, San Martin, Cedros, the three San Benitos, Natividad, San Roque, Asuncion, Magdalena, and Santa Margarita (see map, page 73).

A CRUISE AMONG DESERT ISLANDS

By G. Dallas Hanna and A. W. Anthony

With Illustrations from Photographs by G. Dallas Hanna

The authors of the following article were in charge of the scientific work of an expedition organized under the direction of Dr. Barton Warren Evermann, Chairman of the Committee on the Conservation of the Marine Life of the Pacific, appointed by the Pacific Division of the American Association for the Advancement of Science. The expenses of the expedition were borne jointly by the National Geographic Society, the California Academy of Sciences, the San Diego Society of Natural History, and the Scripps Institution for Biological Research. The Government of Mexico coöperated by providing its fisheries patrol boat, "Tecate," Captain Victor Angulo. During the cruise specimens of birds and mammals, reptiles and amphibians, insects, land shells, marine fossils, plants, fishes, and strange and rare forms of animal life, many of them entirely new to science, were obtained and have been submitted to specialists, who are preparing technical reports to be published subsequently.—The Editor.

THE islands off the west coast of Lower California are widely scattered over a section of the ocean which provides a very scant rainfall. As a consequence, desert conditions prevail among them.

The most interesting of these islands is Guadalupe. It rises precipitously from abysmal depths, a volcano some 12,000 feet high but with only 4,500 feet above the sea. It has never been connected with other shores and it is, therefore, an oceanic island in every respect. All of its animals and plants have either come to it over or through the ocean.

This enforced isolation of the species which have come to Guadalupe has caused them to become modified into many distinct forms which are of great interest to students of biology. But, aside from this "esthetic" value, the island has been of very considerable commercial importance because of the great abundance there at one time of certain species of marine mammals.

Guadalupe is the sole remaining home of the only remnant of a herd of elephant seals in the Northern Hemisphere. Its fine herd of fur seals was hunted and persecuted until apparently the last survivor succumbed to the buckshot of the hunters. At least 200,000 skins of this valuable fur-bearer, which, at present prices, would be worth more than $6,000,000, were taken from the island.

Guadalupe, Mexico's westernmost possession, located 180 miles southwest of San Diego, California (see map, page 73), is about 20 miles long and six miles wide. It is known to have been visited by fur-seal hunters in the early part of the nineteenth century.

These hunters may have been the intrepid deep-water whalers who sailed from New England ports and who occasionally took a vacation from their regular business with harpoon and try-pot to discover and raid most of the fur-seal and elephant-seal rookeries of the world. Or they may have been out for fur seals and sea otters alone, working in partnership, as they did, with the Russian pioneers of Sitka and Kodiak, Alaska. It was these last who took 200,000 fur seals from the Farallon Islands, just outside the Golden Gate, in the short space of three seasons, about 1810.

Guadalupe first appeared upon maritime charts in 1837, after the visit to the west American coast by the French Admiral, Dupetit-Thouars.

The world's greatest herds of fur seals have been so long commercially extinct that people have come to associate the name only with the species which resorts to the Pribilof Islands, in Alaska, where, by long and bitter fighting of diplomatic and legislative battles, the United States has been successful in preserving the largest herd now in existence. But once

XUM

THE LANDING PLACE AT THE NORTHEAST END OF GUADALUPE ISLAND

The white building was erected as a barracks when the Mexican Government had soldiers stationed on the island. Most of the other buildings were occupied from time to time by persons interested in the goat ranch (see text, page 82). The buildings were unoccupied at the time of the visit of this expedition.

there were several other herds, much larger, in the Southern Hemisphere.

The species which lived on Guadalupe was akin to these last and not to the Alaskan forms, although the furs were almost equally valuable and brought good profits to the hunters. Guadalupe being such a distant outpost of Mexico, it is doubtful if a single official of that government had the faintest conception of the war of extermination at the time it was taking place.

So far as the available records show, the last living fur seal was seen on Guadalupe in 1892. Since then several expeditions besides our own have gone to the island and searched for the animal without success.

Our party cruised completely around the island, examining the shores minutely in the hope that at least a single pair had escaped the last butchery. But, after six days of anxious searching, we turned the prow of the *Tecate* toward San Quintin

Bay, fully convinced that we were about 40 years too late to offer this fine species any assistance.

While on the island we examined the ground of three former fur-seal rookeries with scrupulous care, measured the areas and computed the number of animals which once hauled out there to rear their young.

South Rookery originally contained at least 50,000 fur seals and compared favorably with the major breeding grounds of the Pribilof Islands to-day. The entire Guadalupe herd must have numbered at least 100,000 animals when it was in its prime.

Without printed records, how do we know this, thirty years after the last of the animals died? They left their own records, which can be read almost as plainly to-day as if each animal were in its place; and this makes the realization of the facts all the more bitter.

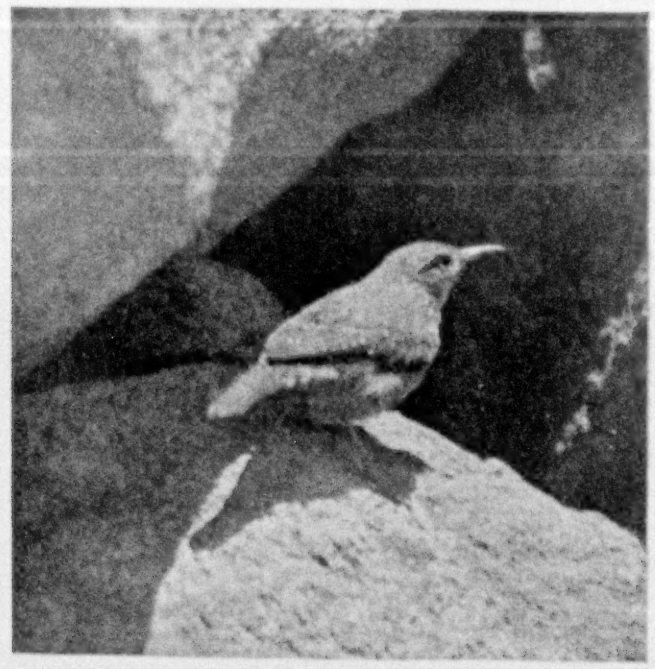
The animals chose the roughest and most rocky shores for their land homes and congregated in large, compact rookeries, in conformance to the habit of fur seals generally. The constant trampling of thousands upon thousands of flippers over the hard blocks and boulders of lava rock wore them down to the smoothness of polished marble. And there they are to-day, silent monuments to a helpless animal which paid dearly for having a skin coveted by man.

THE HERD WOULD HAVE BEEN WORTH MILLIONS TO-DAY

If the original breeding stock had been preserved and allowed to remain constant, only the annual increase being removed each year, the herd would have produced millions upon millions of dollars in the 125 years since the slaughter began. At $30 per skin (present market value of a fur seal), the annual increase from a herd the size of that which once inhabited Guadalupe would be about $750,000. This is 5 per cent interest on $15,000,000, which represents the actual value the herd would have to-day.

So the Guadalupe fur seal has joined the passenger pigeon, the Steller's sea-cow, and the dodo in oblivion.

The great slaughter of the Guadalupe fur seals took place between 1800 and 1830. The hunters then thought they had

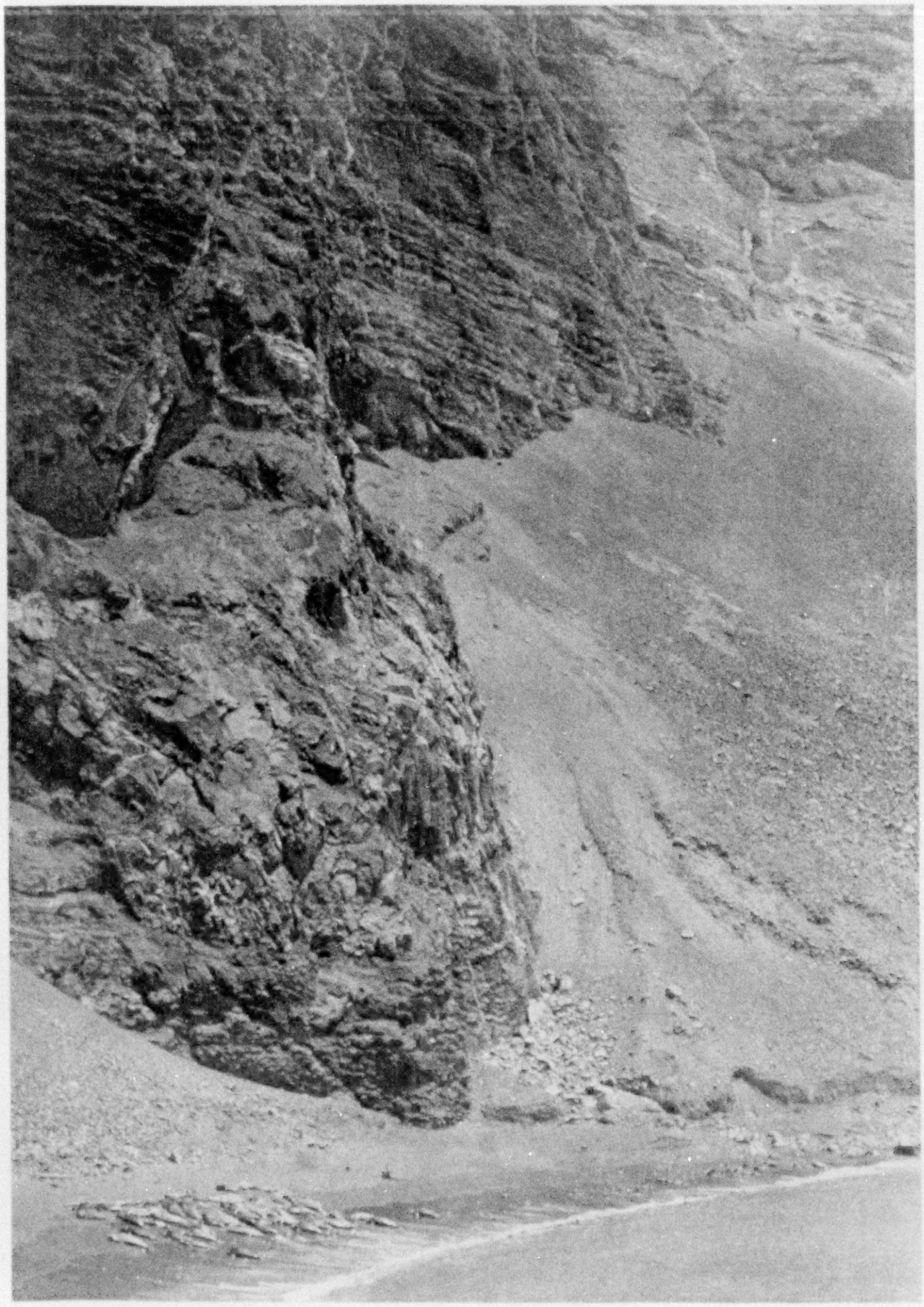


A GUADALUPE ROCK WREN

This gentle and confiding little creature greets the visitor upon his first landing on Guadalupe Island. It seems to delight in investigating its human visitors at close range and does not hesitate to perch on hat, shoulder, or foot.

Drawn by James M. Darley

A SKETCH MAP SHOWING THE DESERT ISLANDS OFF THE COAST OF LOWER CALIFORNIA



MASSIVE WALLS OF LAVA, TWO THOUSAND FEET HIGH, BOUND THE ELEPHANT-SEAL BEACH OF GUADALUPE ISLAND (SEE TEXT, PAGE 75)

The animals cannot be approached from the land side; if they were as well protected from the sea, there would be no reason to fear their extermination at the hands of oil-seekers.

killed all the animals, and the island was forgotten for many years; but about 1880 it was rediscovered and several thousand seals were killed in a few succeeding seasons.

Stories are still heard in San Diego of the last killings which took place. The fur-bearers were pursued into the dark recesses of volcanic beach caves and shot or clubbed by the light of torches.

At South Rookery the stone foundations of 16 huts still stand, conclusive evidence that a considerable number of persons must have engaged in the affair. A walled-in driveway was constructed from the beach to the tableland above, where the animals were driven for slaughter. There, on smooth sand, the skins were spread out to dry and thousands of the wooden pins with which the pelts were pegged down still remain, showing the outlines of the skins.

At Jacks Bay Rookery the driveway leading to the tableland was partially constructed of trunks of palm trees carried from far up in the canyons.

FOUR FRAGMENTS OF SKULLS REMAIN

It was at this place, in 1892, that four fragments of skulls of fur seals were picked up and upon these the scientific description of the species was based. These bits of skulls are now preserved in the United States National Museum, and to this day not another fragment has been found, unless some old bones we picked up should prove to be of this species. There is not a published record of a skin or a perfect skull in existence.

The dodo and the great moa of New Zealand are better represented in our museums than this valuable animal which once lived in herds of tens of thousands a few miles from our mainland.

Another interesting sea mammal is the Guadalupe elephant seal—a huge, clumsy beast with a long flexible trunk. The animals were at one time widely distributed and abundant on many of the remote islands of the Antarctic region,* but the whalers soon learned that a fair quantity and quality of oil could be obtained from each carcass. So the slaughter began, and ended only when the species was commercially exterminated.

The animal found on Guadalupe is similar to, but not the same species as that of southern waters, but it suffered equally from the attacks of the whalers. Originally the northern species was found not only on Guadalupe, but also on the San Benitos, Cedros, and even on the coast of Lower California. These outlying rookeries were soon destroyed, however.

More than once it was thought that the last living representative of the species had been killed; but fate has dealt more favorably with it than with the fur seals; each time a nucleus escaped to rebuild the herd.

We found these animals at the original Elephant Seal Beach, a slight indentation of the northwest shoreline of Guadalupe. Precipitous, unscalable cliffs wall in the beach on the back, so we landed at one end very quietly, without disturbing a single animal.

Counts were made and photographs, including motion pictures, were taken. It was found that a much more satisfactory enumeration could be made from an enlargement of the photograph of the herd shown on page 80 than by a count in the field.

On July 12, 1922, we found 264 animals present. The breeding season had passed and, except in a very few cases, the females and young were absent. An estimate of the entire herd based upon the number of males found gave a total of almost a thousand. This was a most encouraging find and served, in a way, to offset the disappointment experienced over the failure to find a single fur seal.

If vandals and unscrupulous hunters can be prevented from raiding the rookery, the species can be preserved indefinitely. Individuals might then be obtained through the Mexican Government for museums and zoölogical parks. And eventually, when the herd shall have increased several fold, the government can doubtless derive a considerable revenue from the surplus of the herd.

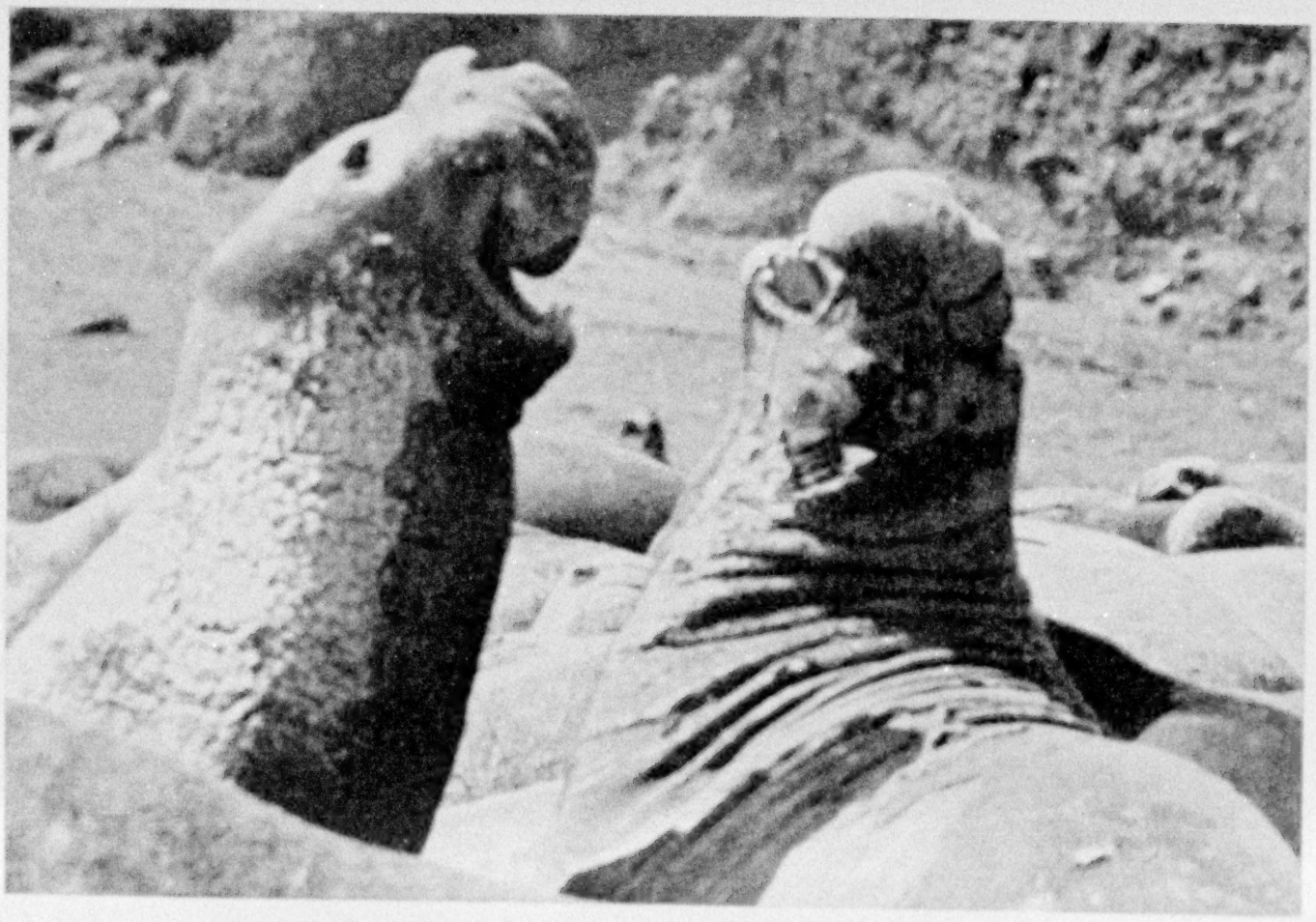
MEXICO MAKES GUADALUPE A GAME PRESERVE

As soon as our expedition returned and submitted reports, prompt measures were

* See "South Georgia, an Outpost of the Antarctic," by Robert Cushman Murphy, in THE GEOGRAPHIC for April, 1922.

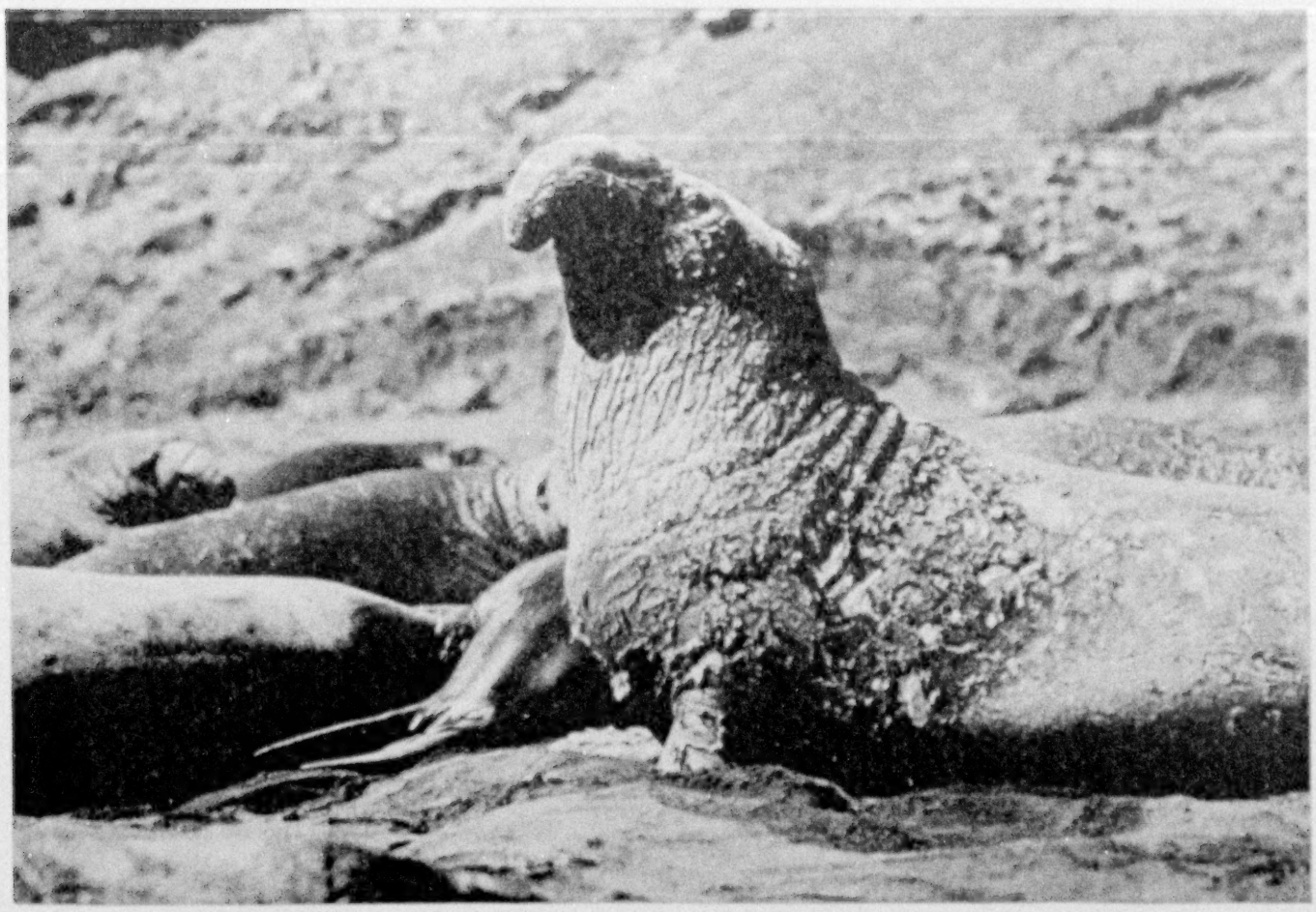
TOO LAZY AND TOO FAT TO BE IN A HURRY

A Guadalupe elephant seal coming up on the beach out of the sea.



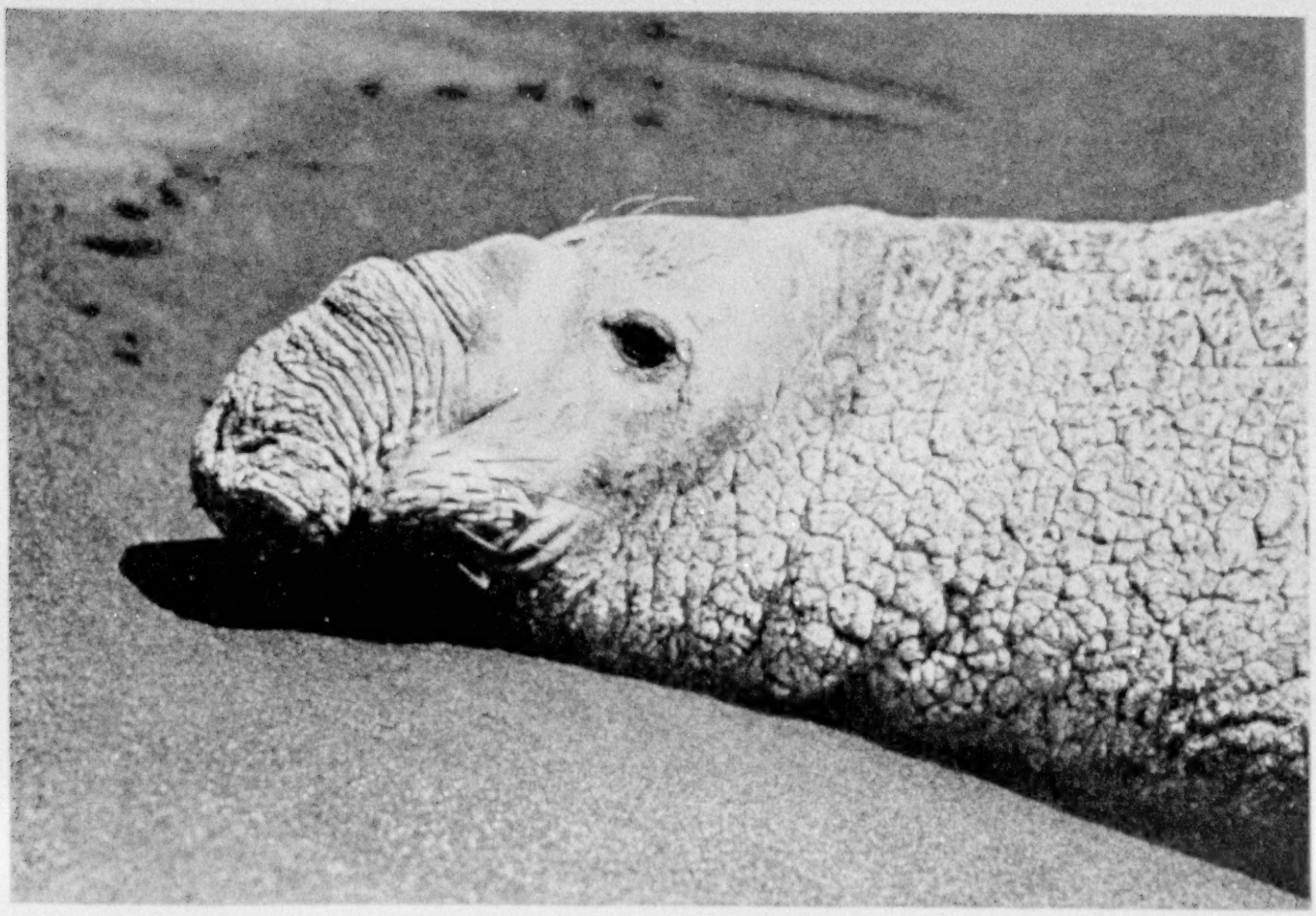
A TRUMPETING DUET

The Guadalupe elephant seals give their call with noses blown full of air like toy balloons and with proboscides placed in widely opened mouths (see text, page 81).



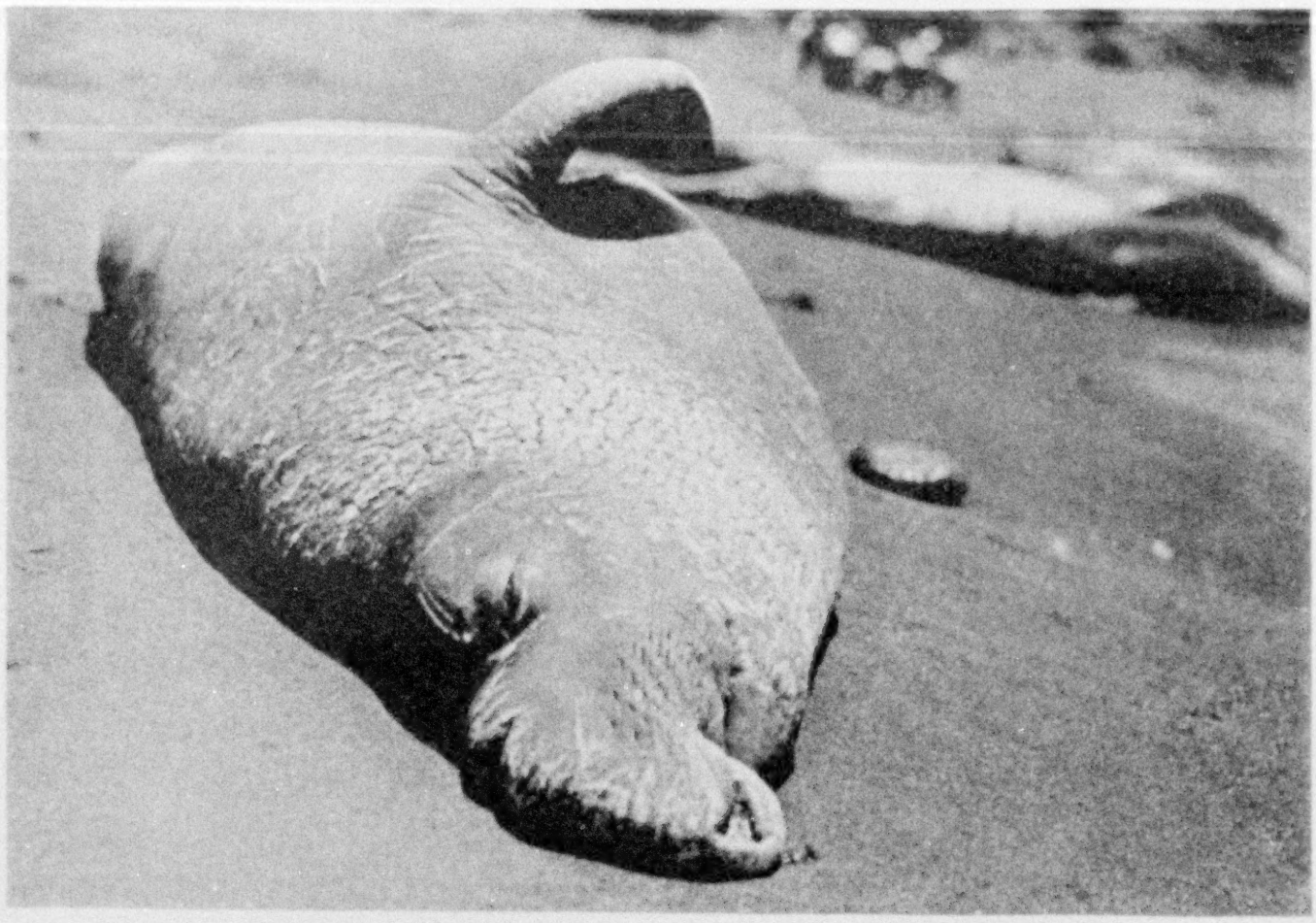
THE GUADALUPE ELEPHANT SEAL SHEDS ITS CUTICLE AS WELL AS ITS HAIR

This specimen is peeling off like a sunburned bather (see text, page 81).



A CLOSE VIEW OF THE ELEPHANT SEAL'S WARTY AND WRINKLED NECK

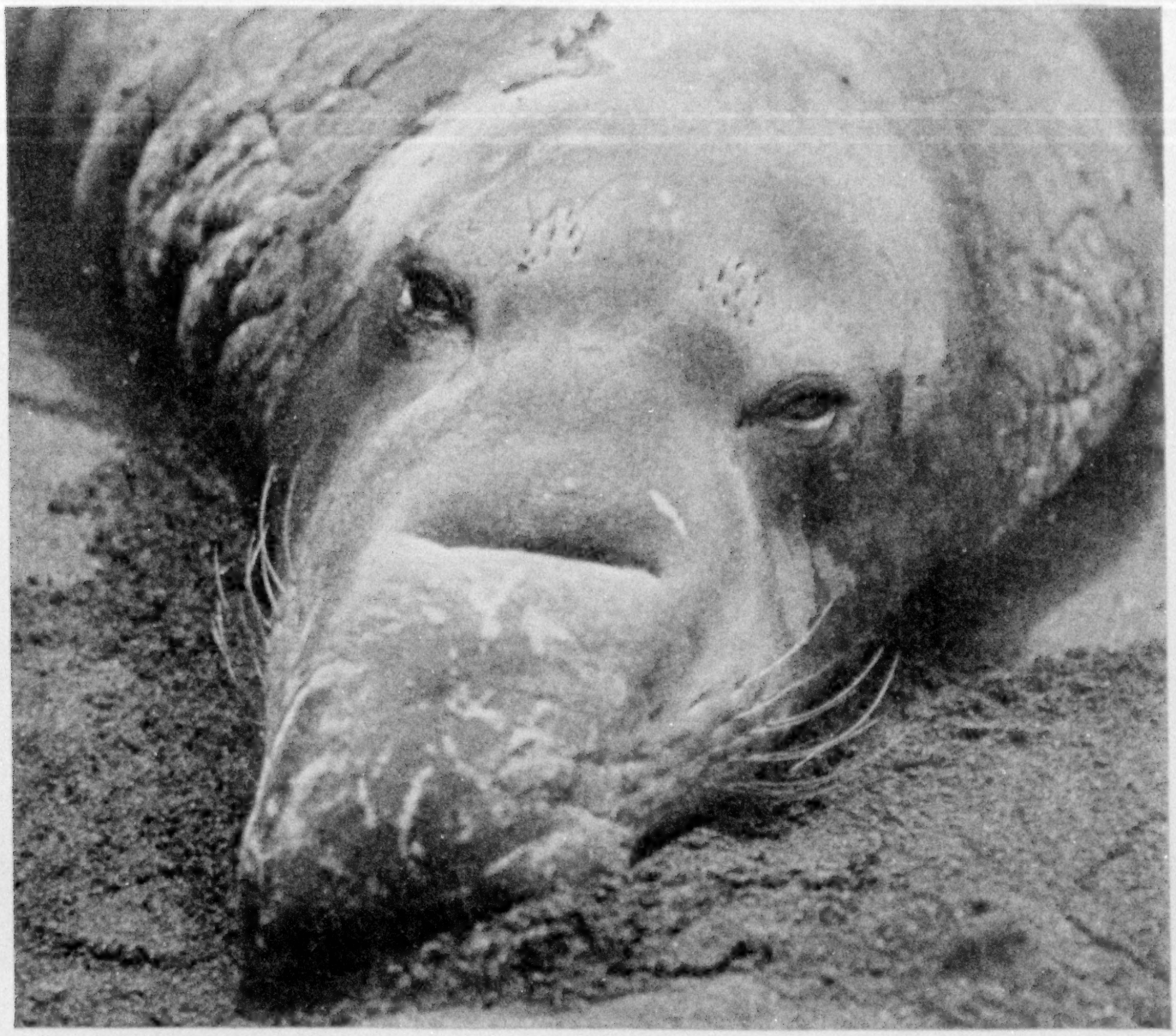
It becomes a bright geranium pink after the old cuticle and hair have been shed. The body of the animal is leaden gray in color.



NOT DEAD—MERELY ENJOYING A SIESTA ON THE BEACH

THROWING SAND OVER ITS BACK, A CHARACTERISTIC HABIT OF ELEPHANT SEALS

These animals are awkward, slow, and deliberate in their movements on land.



WIDE AWAKE AND WILLING TO HAVE HIS PICTURE TAKEN

The camera was placed only a few feet from this elephant seal's nose.

urged for the protection of these interesting animals. President Obregon, of Mexico, almost immediately thereafter declared Guadalupe Island a government reservation. Unauthorized landing is now prohibited and no elephant seal or fur seal can be killed or molested within three miles of its shores. Heavy penalties have been fixed for violation of the protective measures.

It is hoped that additional protection can be had through a treaty with the United States, and perhaps other countries, similar to the North Pacific Fur Seal Treaty, which has resulted in an increase of the Alaskan herd from 127,000 animals in 1911 to more than 600,000 in 1922.

The success of that treaty has demonstrated that international agreement is the only feasible method of protecting any animal which, during a part of its existence, goes into the high seas. There it cannot be protected by one country against the activities of the citizens of another country, and protection on the high seas is essential if a commercially valuable animal is to be saved from extermination.

The elephant seals are awkward, slow, and deliberate in their movements on land. We soon learned that our fear of disturbing them was groundless, for by degrees the entire party walked down among them and some of the boys even slapped them on the back or vaulted over them. They seemed to have no conception of man or fear of him.

Among these strange animals, we seemed to be taken back several geological periods, to the age of the ungainly dinosaurs of the Jurassic or the slovenly,

MEMBERS OF THE EXPEDITION WALKING AMONG A HERD OF GUADALUPE ISLAND ELEPHANT SEALS

The fact that these animals seem to have no fear of man contributed largely to their almost complete extermination when they were hunted by whalers for their oil.

giant amphibians of Carboniferous time. Many things seemed to show that the elephant seals are the survivors of an ancient lineage and do not properly belong to this age of highly organized and specialized birds and mammals.

THE ELEPHANT SEAL USES HIS SNOUT AS A RESONATOR

Instead of shedding the hair, as do the mammals with which we are familiar, the elephant seal sheds the cuticle of the skin; it peels off in large flakes, like the skin of a sunburned bather, and the new skin on the excessively rough and corrugated neck is left a bright geranium pink. Otherwise the animals are a dull leaden gray, with here and there a silvery sheen, such as we often see on hair seals. To these latter the elephant seals bear a closer relationship than to any other existing mammals.

The flexible snout or trunk reaches a maximum length of 16 inches in old males, and, so far as is known, it serves no useful purpose. When the animal throws its head back and utters its deep, snore-like trumpet call, the end of the trunk, blown full of air like a toy balloon, is placed in the widely opened mouth. An accessory resonator is thus produced, which gives the sound a far-away, uncanny tone, like a distant horn blown in the depths of the Louisiana Bayou country (see illustration, page 76).

The snout of the female is imperfectly developed; therefore this organ would seem to have no association with food-gathering habits, but at present nothing is known as to the animal's food or the manner of obtaining it. Several stomachs were taken for museum specimens; in all cases they failed to furnish any data.

ONE OF NATURE'S MYSTERIES

Several elephant seals were seen in the water, where they appeared as ungainly as on land. They seemed to be especially fond of swimming slowly close to shore, with head and hind flippers both out of the water.

The sea round about is too deep for them to go to the bottom for clams, as do the walruses of Bering Sea, and it does not seem possible that so clumsy a creature could capture the fleet pelagic fishes and squids of neighboring waters. Truly the elephant seal is one of the mysteries of nature.

Even without the fur seals and elephant seals, Guadalupe would be one of the most interesting islands of the Western Hemisphere. The sea has eaten its way into the volcanic materials of which it is composed, and exposed the very hearts of some of the craters. One needs but to sail along close to shore and examine the great dike systems, caverns, lava bubbles, and vents to gain an idea of the tremendous dynamic forces which were once at work here.

Many of the canyons are so full of caves festooned with weird lava shapes that it would seem as if Gustave Doré must have visited the place before he drew the pictures to illustrate Dante's "Inferno."

No doubt the desert conditions of today have prevailed since the island cooled; surface erosion has been so slight that the original features have been preserved almost intact.

Some of the northern portion of the island projects upward sufficiently (4,500 feet) to pierce the lower strata of clouds, and this part is bountifully supplied with moisture, chiefly in the form of mist. Here there are some fine groves of pines, cypresses, oaks, and palms, all species found only on this island.

A BIOLOGICAL SEPULCHER

The first naturalist to visit Guadalupe was Dr. Edward Palmer, in 1875. He camped in one of the cypress groves and described the place as a paradise. There were a great many beautiful shrubs and flowering plants in the moisture belt, and the birds were so abundant and so tame that he called it an isle of dreams. Fully thirty species of plants were found endemic among the 140 kinds collected. Juncos, petrels, caracaras, flickers, house finches, house wrens, rock wrens, and towhees were all about him and all were species never before seen by a naturalist.

But conditions were vastly changed at the time of our visit. Guadalupe is a biological sepulcher.

The shrubs and flowering plants have been practically exterminated and for 30 years no young trees have had a chance to grow. Fortunately, specimens of the

CLIFF-DWELLERS ON GUADALUPE ISLAND

These goats have learned to quench their thirst with sea water and have eaten almost every living plant on the island. They are extraordinarily nimble creatures, and these two specimens jumped 40 feet to the talus slope below and walked quietly away when approached by members of the expedition.

pines, palms, and cypresses have been brought to California and planted in some of the parks. The oaks, which apparently have been neglected, are said to have the largest acorns in existence, being fully two inches in diameter.

GOATS HAVE WROUGHT THIS DESTRUCTION

The old trees are fast disappearing through natural death and the effects of storms. Four of the fine species of birds have become extinct and the others are reduced to a fraction of their former number.

The cause of all this death and destruction was the ambition of some one to start a goat ranch on Guadalupe many years ago. The animals, without care, thrived beyond the wildest expectations of the promoters, but the venture proved a failure financially.

The goats have learned to quench their thirst with sea water and have eaten almost every living plant. In seasons of exceptional drouth, when nothing grows on the lowlands, thousands upon thousands of the animals have died, and the canyons, beaches, and caverns are strewn with their bleached bones.

The only source of fresh water on the island is on the higher portion, where there are some small seepages. Around one of these it was estimated there were 5,000 goats when we were there.

At one time Mexico had a garrison of soldiers stationed on the island, and they built a barrack on the beach near the northeast point; they brought burros and mules to carry water down the mountain, over the excessively rough trail. When the soldiers went away they left the animals to shift for themselves, and we found several of them around one of the water-holes, apparently glad to see a human being once more.

Either the goat ranchers or the soldiers liberated house cats, which promptly turned to wild cats and proceeded to subsist upon the bird life of the island. They have been the direct cause of the disap-

pearance of most of the birds, and we saw evidences of their depredations in the form of loose feathers and wings at every landing we made.

CATS ARE EXTERMINATING THE ISLAND'S BIRD LIFE

House mice were also introduced in the same manner and have completely overrun the island. One might think that the cats would kill the mice very promptly, but the birds seem more to their liking.

The cats will undoubtedly exterminate practically all of the birds of the island in the next few years; there seems to be no practicable method to avoid this ornithological catastrophe.

It has been stated that Guadalupe rises from abysmal depths of the ocean. These great depressions of the bottom of the sea are as effective barriers to the distribution of marine animal life as high mountain ranges are to land forms. As a consequence, we found a very scant fauna along the shores. Of mollusks there were not more than half a dozen common species, whereas in the same latitude on the Lower California coast there are hundreds.

Shore fishes were fairly abundant as to individuals, but very few kinds were seen. The most interesting of these was the beautiful *Azurina hirundo*, named by Dr. David Starr Jordan and Richard C. McGregor from three specimens taken there many years ago. These gorgeous little fishes are an azure blue, and as they passed in schools in the crystal clear waters over a background of coral-red algæ, they made a picture long to be remembered.

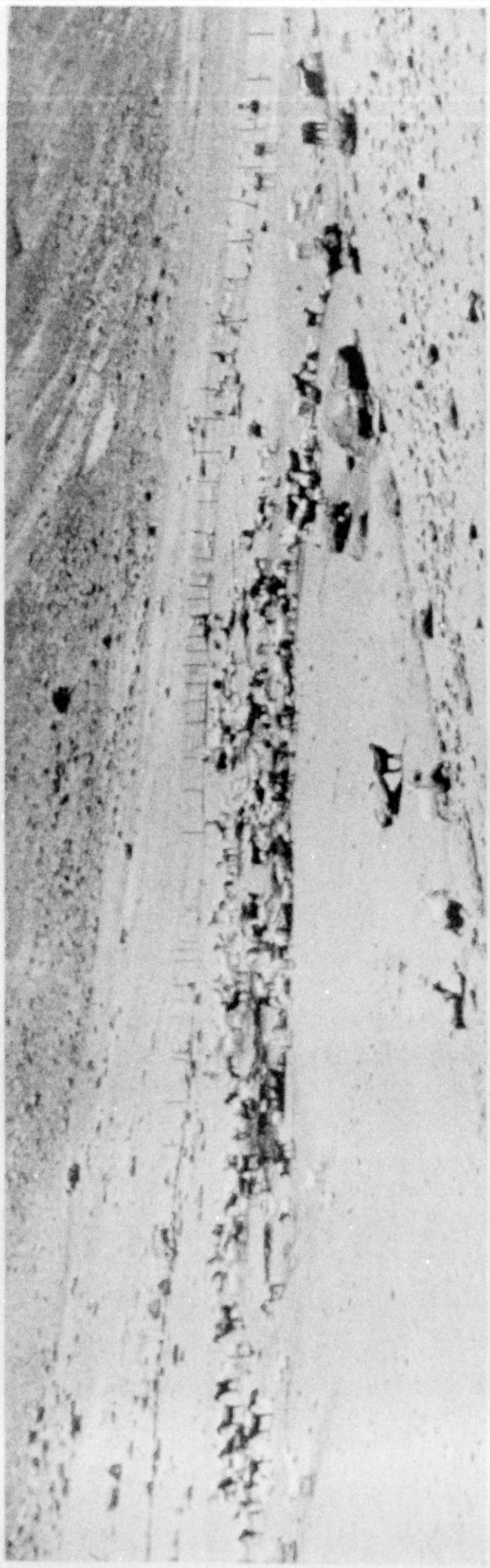
THE CALIFORNIA JEWFISH RESEMBLES OUR RIVER AND LAKE LARGE-MOUTHED BLACK BASS, BUT ON A GIGANTIC SCALE

Although this fish attains a weight of 400 pounds, its flesh is not coarse or unpalatable.

CEDROS ISLAND, ONCE SOURCE OF OTTER SKINS

Cedros Island is slightly larger than Guadalupe and very different in every way. It lies close up to the Lower California coast, but is separated from the mainland by a deep channel. It gets its name (Spanish for *cedar*) from numerous scrub junipers found growing in some parts, and these are usually called "cedars."

The higher ridges of the north end and the central portion have some groves



A FEW OF THE THOUSANDS OF GOATS WHICH ARE DESTROYING EVERY VESTIGE OF VEGETATION ON GUADALUPE ISLAND

The progenitors of this herd were transported to the island many years ago by the promoters of a goat ranch. The venture proved a failure financially, but the goats themselves have thrived prodigiously. (see text, page 82).

of pine trees, but they form a very inconspicuous part of the vegetation.

This island at no very distant date was connected with the mainland, as indicated by the fauna and flora as well as the geology. The northern portion contains metamorphic rocks which in one place are mineral-bearing. Here there has been a gold and copper mine, long since abandoned. Large quantities of machinery and 40 or more buildings stand in a dilapidated condition.

Along the western side of the island are vast beds of kelp, where in the early days of California numbers of sea otters were obtained. The animals hunted crabs around the roots of the kelp and basked in the sun on beds of the fronds. One shipment from San Diego to Manila, in the early days of Spanish occupation, consisted of 9,000 sea-otter pelts. This cargo would be worth more than $10,000,000 at present market prices. Not all of the pelts were secured on Cedros Island, but it was a prolific producer.

A SIX-POWER TREATY PROPOSED TO PROTECT THE OTTER

One of the objects of our expedition was to determine the present status of the sea otter, so as to be able to make recommendations for its protection which would enable it to regain its former abundance all along the coasts of Washington, Oregon, California, and Lower California. We therefore made inquiries about it wherever possible. We did not see any of the animals, but it is probable that there are still a few alive. If stringent action be taken for the protection of the species over a long period of years, it would seem to be possible for the sea otter again to become one of our important fur-bearers.

It has been recommended that

A CROSS-SECTION OF LIFE ON ONE OF THE DESERT ISLANDS OFF THE COAST OF LOWER CALIFORNIA

In the foreground is a group of California sea lions; in the middle background may be seen one of the "islands" of black cormorants (see also pages 92 and 93), and the ridge top at the left is serrated with stately pelicans.

SEA LIONS ON EAST BENITO ISLAND

These animals are far more timorous than the elephant seals; they take to the water at the first sight of man.

WEST BENITO ISLAND'S HERD OF SEA LIONS

The folded and twisted rock formation shown in this photograph was once a large rookery of fur seals, but they long ago disappeared as a result of the onslaught of hunters who came chiefly from United States ports (see text, page 73).

SEA LIONS RESTING ON THE UPTURNED ROCK STRATA OF WEST BENITO ISLAND

These are the animals familiar to vaudeville and circus patrons as "trained seals."

the killing, molesting, selling, or possessing of any sea otter or portion thereof be prohibited for a period of not less than 25 years in United States territory, and that similar action be urged upon other countries. To be most effective, these conditions should be embodied in a treaty entered into by the United States, Mexico, Canada, Japan, Russia, China, and perhaps some others.

There are numerous springs of fresh water in the mountain canyons of Cedros Island, but in few cases do they reach the sea; most of them are lost in the burning sands of the canyon bottoms. Around these water supplies there is a luxuriant growth of vegetation, but elsewhere the lowlands present a desert aspect.

THE ELEPHANT TREE IS AN ARBOREAL MONSTROSITY

Several species of cacti abound, but the most conspicuous portion of the vegetation is the strange, grotesque, elephant tree. With a base three feet in diameter and a height of about eight feet, it would be hard to imagine a more monstrous plant growth; it seems pathological, like a tumor. The bark is yellowish white and

SEA LIONS SPORTING IN THE SURF OFF ASUNCION ISLAND

peels off like that of a paper birch, but is fully an inch thick and upon being punctured exudes a thick, viscous milk (see illustration, page 95).

Near the southern end of the island an abalone packing company has brought the water of one of the springs from three miles inland down to the beach. The pipe is laid on top of the ground. On a July afternoon, when we were there, the water reached a temperature of 145° and could not be used for drinking or bathing. This serves to illustrate the excessive heat of the island desert.

Abalones abound around the rock-ribbed shores of Cedros, and an important industry is being developed. Some of the mollusks are dried for the Chinese market, while others are canned for American consumption. The abalone is known chiefly as the source of the pearly shells used in the manufacture of opera glasses and umbrella handles, but it is a mollusk which many epicures find delicious. It has become so popular as a food in California that it is gathered under stringent restrictions and exportation from the State is prohibited. Mexico has likewise adopted restrictions.

The Mexican abalone diver uses standard equipment and stays down in 25 to 40 feet of water for four hours at a shift. He pries the shell-fish loose from the rocks with a steel bar and sends them to the surface in large wire cages. The drying is done in the sun, after three intermittent steam cookings (see page 94).

FISH MEASURED BY THE CUBIC MILE

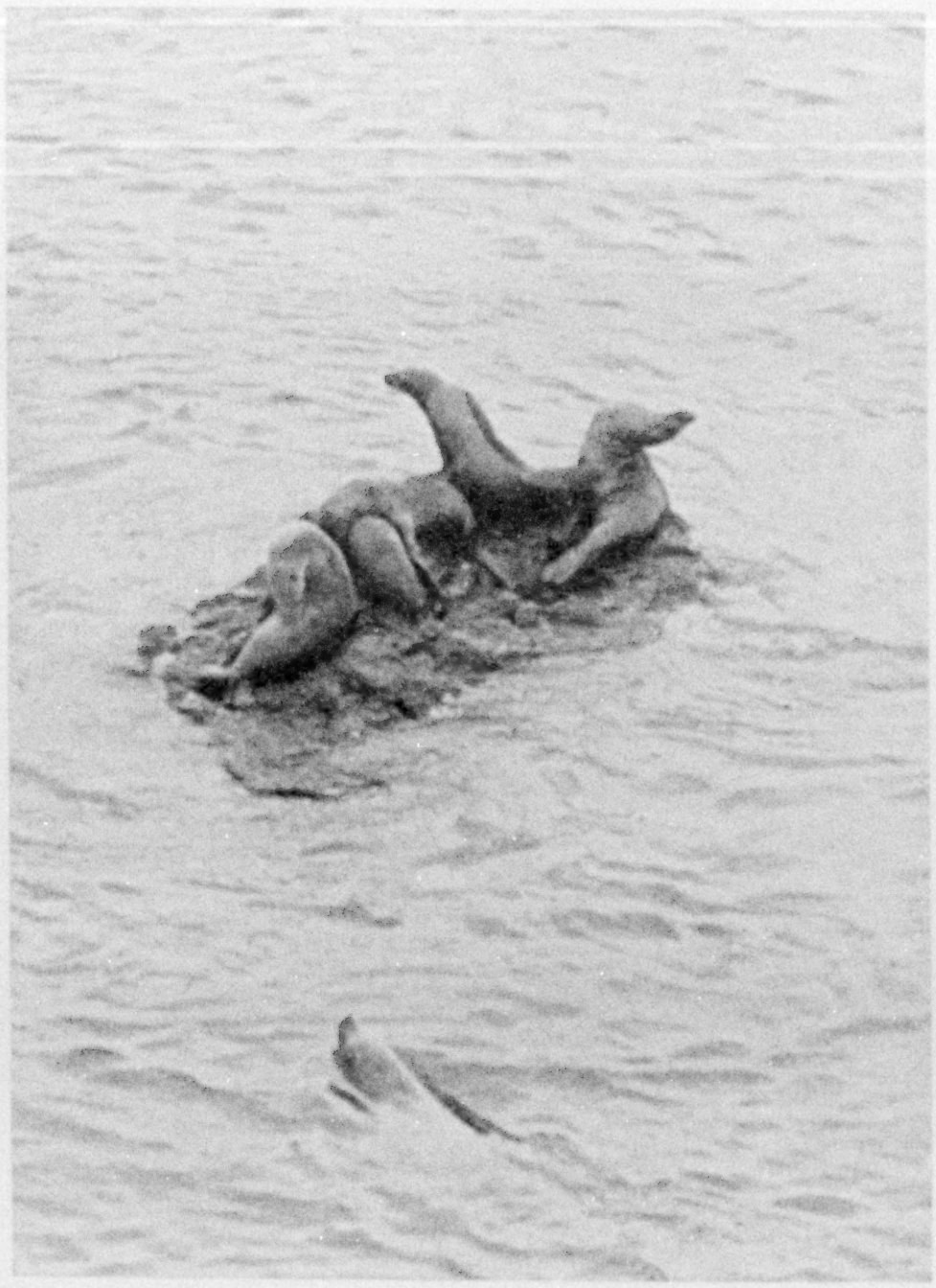
The fisheries of this portion of Lower California waters are almost untouched, yet they are capable of very extensive development. Albacore, sea bass, yellow tail, bonito, dolphin, mackerel, jewfish, and sardines exist in untold abundance. Of the last there was a zone completely around Cedros Island at the time of our visit. The numbers were so great that

they could hardly be estimated except by some such unit as a cubic mile.

Other fishes in inestimable numbers were preying upon them. The giants of all were the great jewfish, some of which weighed 400 pounds each (see p. 83). We found them acceptable sea food and equal to halibut or salmon of more northern waters.

Some of the pelagic fishes, such as the skipjack, bonito, and mackerel, caught on a troll behind the vessel, rank among the most beautiful creatures of the sea; the rainbow colors of the bonito particularly cannot be excelled for beauty by any dweller of more tropical waters.

In winter the spiny lobster is caught in abundance off the shores of Cedros and shipped to San Diego, Los Angeles, and San Francisco. The "pots" or traps were in evidence at almost every landing we made. The supply in California has been greatly reduced through overfishing, and it is hoped that Mexican regulations will be made sufficiently stringent to furnish a constant supply from Lower Californian waters.



SEA-LION COWS RESTING UPON AN OUTLYING ROCK OF EAST BENITO ISLAND

MANY INTERESTING ANIMALS FOUND ON CEDROS ISLAND

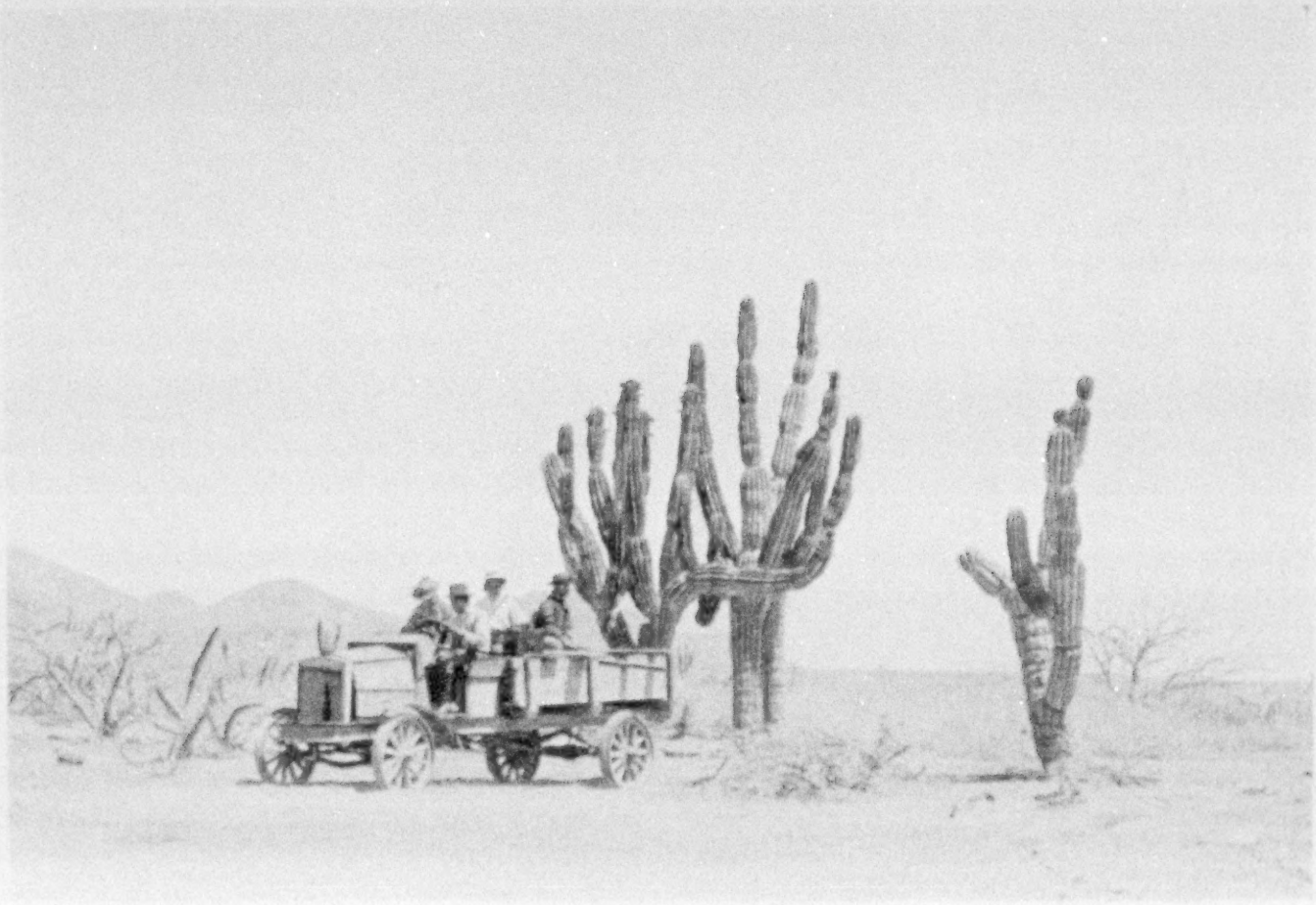
There are many interesting species of land animals on Cedros Island. Deer, rabbits, and several kinds of wild rats and mice are to be found; also rattlesnakes, gopher snakes, several kinds of lizards, and a tree-frog. Goats, cats, and dogs have been liberated on this island, too, and they have turned to the wild state, but have not yet become common.

The cats will have a much more difficult time here than on Guadalupe, because birds are scarce and they are extremely wild and wary.

East Benito, West Benito, and Middle Benito lie close together, about 15 miles west of Cedros. Fur seals, elephant seals, and sea otters were once found here in abundance, but a few bones of the elephant seals were the only traces of them remaining. California sea lions, however, were abundant. These barking animals, familiar to the patrons of circus and vaudeville as "trained seals," were found on every island we visited.

These animals are being put to no commercial use at present; therefore protective legislation is not immediately needed. For this reason it would be much easier at

EVEN THE HARDY CACTUS CANNOT EXIST IN THIS PART OF CEDROS ISLAND



THE GIANT CACTUS OF SANTA MARGARITA ISLAND

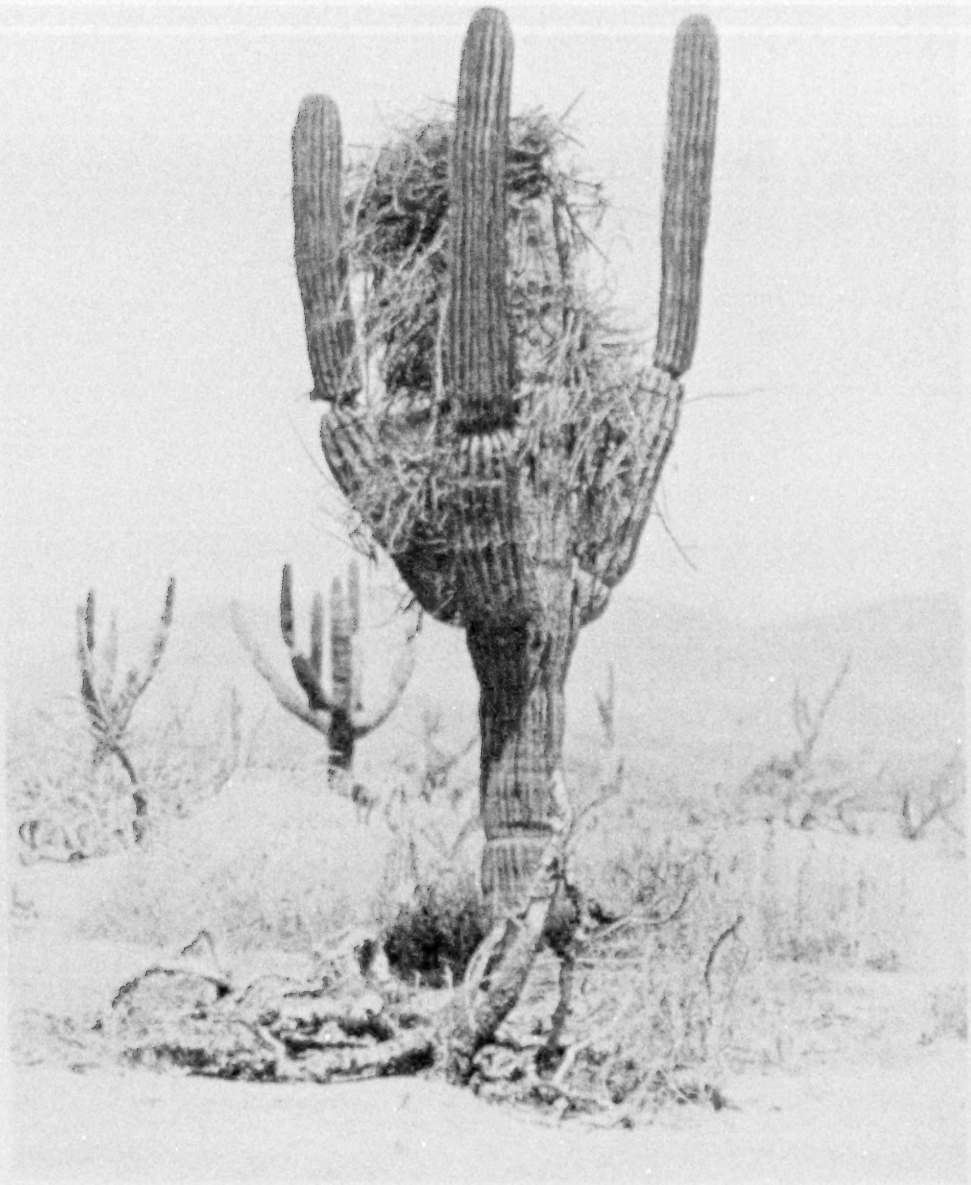
The fruit of this species is delicious. It can be seen as small knobs on the upper ends of some of the branches. The truck shown in the illustration was used during the World War for hauling magnesite from the hills in the background to the boat landing, whence it was shipped to the United States for use in smelters (see text, page 97).

this time to pass laws which would effectively protect the animals from extermination, should an industry be developed.

The characteristic plants of the San Benitos are cacti, of which there are several species. One of the most annoying is the vicious cholla (pronounced chòya), the barbed thorns of which are as sharp as the sharpest needle and are very difficult to extract, once they have penetrated the skin.

Cats have also been liberated on all of these islands, and they have worked havoc with the birds. McGregor's house finch was a form found in no other place, but it has been practically exterminated; we saw but a single individual where a few years ago there were hundreds.

We found a crew of Japanese on West Benito Island industriously gathering and drying abalones. They had brought their fresh water from San Diego, 200 miles away.



AN OSPREY'S NEST IN A GIANT CACTUS

Locations for nesting sites on the desert islands off the coast of Lower California are at a premium, and on Santa Margarita Island many giant cacti suitable for holding the bulky structures of the osprey are occupied. Each year the nests are supplied with more sticks and rubbish until, in some cases, the cactus breaks under the weight.

Some years ago it was discovered that three species of petrels—least, black, and Socorro—nest in burrows on the San Benitos. The discovery produced a mild sensation in ornithological circles, because previously the first of these species had been scarcely known to science.

This little bird, hardly as large as the English sparrow, has never been found nesting elsewhere, but there are thousands of them on these islands in the breeding season. They fly by night and kept up a continual chatter over the *Tecate* as it lay at anchor. Occasionally one would be blinded by one of our lights and fly to it like a moth. During the day they remained either in their burrows with the single egg or chick or far at sea. They are wide-ranging fliers like the albatrosses, to which they are related. The sailor calls them sea swallows.

There are no indigenous land mammals on the San Benitos, nor are there any snakes, and we found only a single species of lizard. Insects and land shells occur in abundance. The latter were first made known to the world through the visit here of the officers of the British survey ships

CORMORANTS ON ASUNCION ISLAND: EACH WHITE SPOT ON THE HILLSIDE IS A NEST

SHALLOW CORMORANT NESTS ON SAN ROQUE ISLAND

Every available piece of movable vegetation is used in constructing these nests, and sea weeds and feathers are used as supplementary building material. The nests are arranged in large, compact groups for protection from the marauding gulls.

YOUNG FARALLON CORMORANTS ON NATIVIDAD ISLAND

Pandora and *Herald*, between 1845 and 1851, and the shell was named *Helix pandoræ*.

NATIVIDAD, SAN ROQUE, AND ASUNCION ISLANDS

Situated eight miles south of Cedros Island, Natividad partakes of many of the characteristics of its larger neighbor. On the other hand, there are many striking contrasts. There are no indigenous land mammals except a white-footed mouse; snakes are absent, but there are two species of lizards. There are no trees and little brush, but the giant cactus stands, sentinel-like, on many of the higher parts.

San Roque and Asuncion Islands are much smaller and are a few miles farther south. All three of these are essentially sea-bird islands. Gulls, cormorants, and pelicans nest here by thousands and much of the land is white with guano. A considerable amount of this fertilizer has been shipped, and it is said that boats occasionally come for cargoes from Gulf of California ports. The chief use of the islands, however, is as landing places for the lobster fishermen.

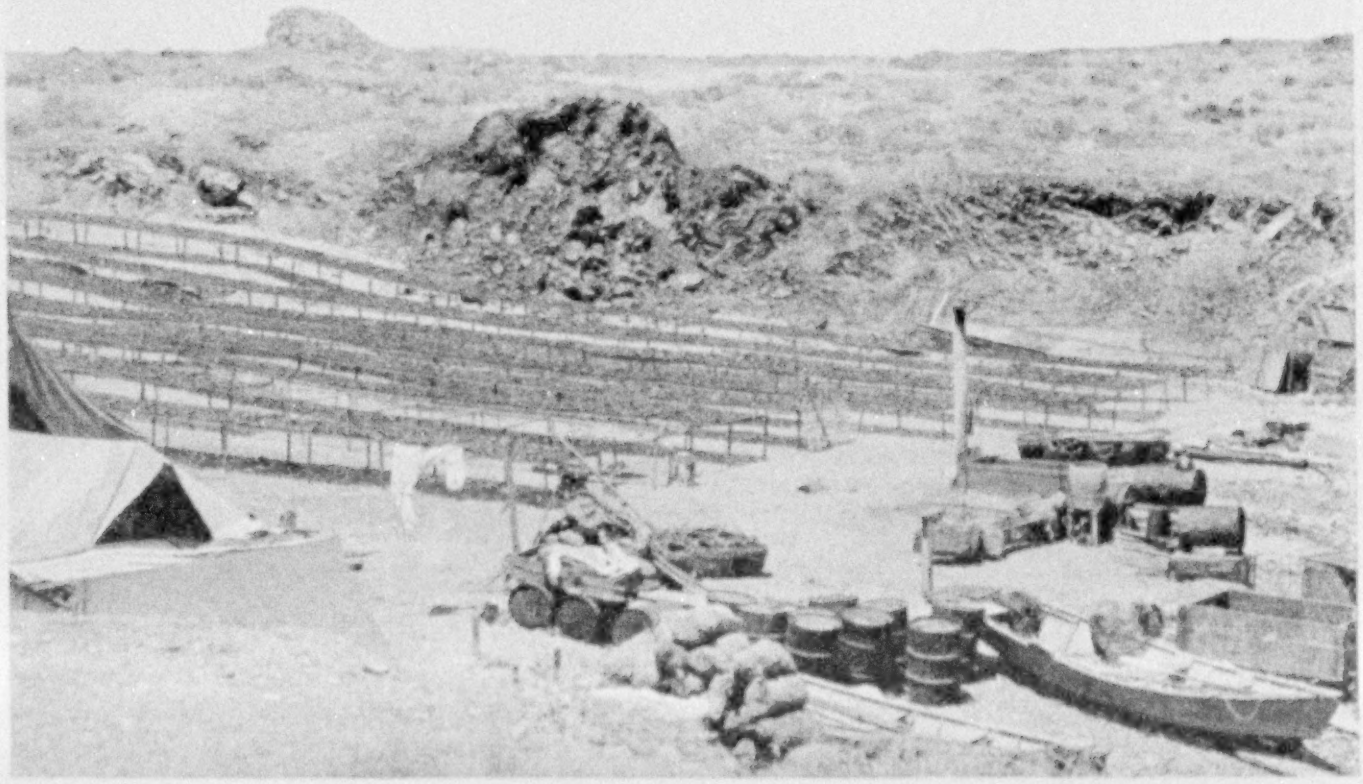
From our observations the sea gulls, of which poets sing, does not deserve all of the fine things which have been said about it. These birds are guilty of much depredation upon the rookeries of the cormorants, which build their nests close together, the black groups at a distance appearing like islands on the background of white guano (see page 85).

Evidently the cormorants derive a certain amount of protection through this close association of large numbers, because the gulls do not molest them to any great extent so long as they are left undisturbed. But when the cormorant rookery is disturbed, the gulls take advantage of the opportunity and pounce upon the nests, killing young birds and breaking eggs by the hundreds. They can eat or carry away only a fraction of the chicks and eggs they destroy.

Walking on the uplands of these islands is difficult, for one is constantly breaking through into the tunnels or burrows of black-vented shearwaters. These birds also belong to the family of albatrosses, and, like their relatives, roam far and wide over the sea; yet they invariably

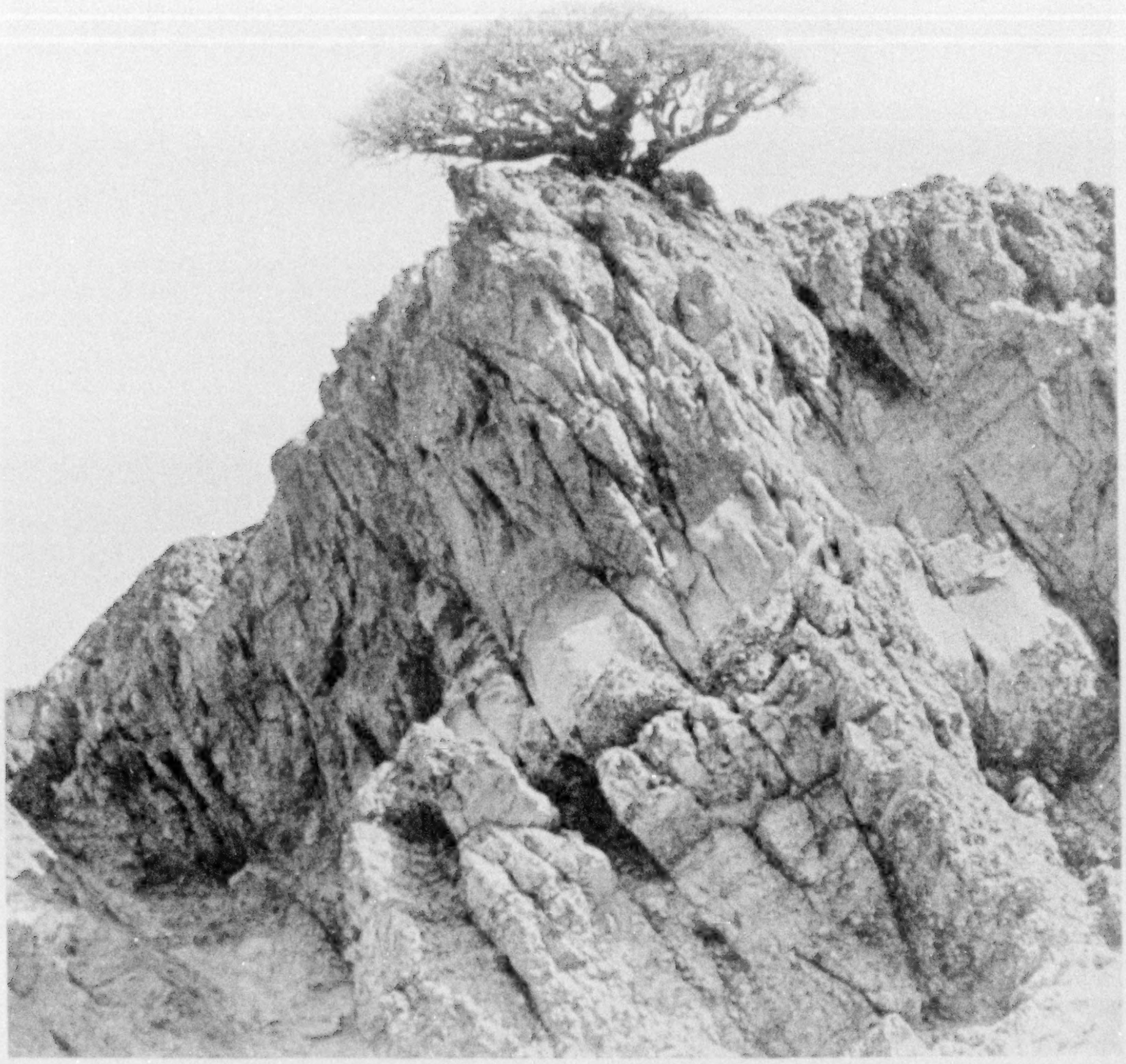
THE UPTILTED SEDIMENTARY STRATA ON CEDROS ISLAND

These rocks are of great age and their position indicates the tremendous geological disturbance which occurred here in times past.



EQUIPMENT FOR DRYING ABALONES ON WEST BENITO ISLAND

The mollusks are first cooked in boilers, then spread on the wire frames to dry in the sun.



AN ELEPHANT TREE ON CEDROS ISLAND

This desert species seems to thrive as well in such inhospitable places as on the valley floor. Its clusters of beautiful pink flowers are in strange contrast to the grotesque shape of the trunk (see text, page 87).

return to these particular islands to rear their young.

Most of them had left the burrows at the time of our visit and we saw flocks of tens of thousands in the sea a little to the south.

At the eastern end of Asuncion Island is a precipitous, flat-topped rock occupied by sea lions and birds. Beetles were exceptionally abundant on the tableland and the specimens which we collected have been enthusiastically studied by entomologists since our return. Since the rock is without a name on available charts and one is needed to designate it in the technical reports, we propose that it be called Angulo Rock, after the genial captain of the *Tecate*.

TWO ISLANDS GUARD ONE OF THE WORLD'S FINEST HARBORS

Magdalena and Santa Margarita Islands form the outer barrier to Magdalena Bay, one of the most beautiful harbors in the world. It is deep, wide, and unobstructed at the entrance and has sufficient room for all the navies of the world to swing with the tide. Storms are practically unknown

BROWN PELICANS IN FLIGHT

Although these birds appear awkward on land and in diving for fish, they are the epitome of grace on the wing.

and the temperature is mild and equable throughout the year.

But Magdalena Bay has two serious drawbacks which have prevented its development: there is no adequate supply of fresh water available and the surrounding country is the most barren of deserts. It is said that there have been periods of five consecutive years without a single drop of rainfall in the vicinity. Such difficulties are almost insurmountable. Nevertheless, a few people eke out a precarious existence here.

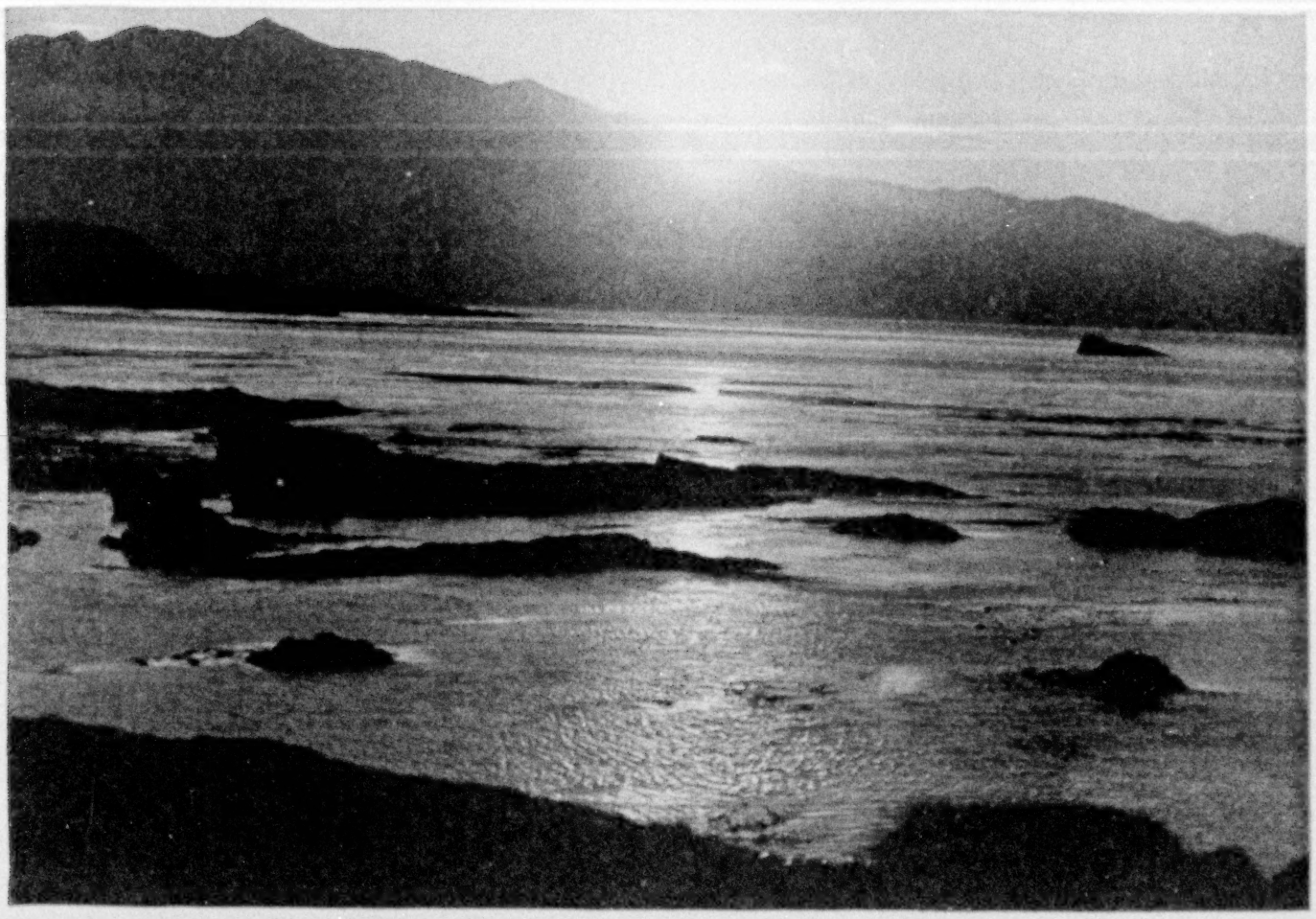
DYE LICHENS ONCE GATHERED HERE

Magdalena Bay village was formerly headquarters for a company engaged extensively in gathering a species of lichen called orchella, from the country round about. The lichen grew upon other plants, in festoons and bunches, somewhat like the Spanish moss of our Southern States. It was baled and shipped chiefly to Germany for the manufacture of dyes, but the development of the coal-tar colors has destroyed the orchella industry.

On Margarita Island there is a fishery by-products establishment engaged in the manufacture of fertilizer and oil from a small species of herring found most abundantly in the bay. Employment is given to perhaps 30 people.

And on the seaward side of this island a Mexican family was found living very close to nature, on what they called their ranch. It was difficult to understand how they managed to subsist under such trying conditions. The Eskimo of the frozen zone has a paradise by comparison. Subsurface fresh water had been obtained from wells, but it was so salty we could scarcely drink it.

These islands are separated from the mainland by narrow lagoons which are bordered by impenetrable mangrove swamps. Wood-rats build their bulky nests in the mangroves like squirrels, and crabs swarm and rattle their claws on the mud beneath.



SUNRISE ON THE ROCK-BOUND SHORES AT THE SOUTHERN END OF CEDROS ISLAND

Although the nights are pleasant, the sun beats down mercilessly on the barren desert at noontime, and there is seldom a drop of rain in this part of the world.

In these swamps we found Xantus jays and the rare and beautiful mangrove warblers. Great black moths flitted here and there over the bushes, while herons and egrets perched nonchalantly on projecting stubs.

A TROPICAL SETTING

Out in the bay the brown pelicans were constantly diving in an endeavor to satisfy insatiable appetites, while high over head man-o'-war birds were coming and going, with the ends of their journeys dark secrets, as far as we were concerned. All of this produced a tropical setting such as we had not experienced elsewhere on the cruise.

The land animals of these islands consist of jack rabbits, coyotes, rats, mice, rattlesnakes, and lizards of several species—rather an uninteresting array except to the specialist. To him the desert conditions have produced many modifications which are striking. On Santa Margarita, for instance, the jack rabbit has become very dark in color, just the contrary to what one usually associates with such situations.

Cacti form the main element in the vegetation, and there are many striking species. On Santa Margarita there is a fine forest of the giant species and many of the trunks reach an altitude of 60 feet. The fruits were just ripe when we were there, in July, and the woodpeckers and cardinals were having a great feast. We tried the fruit and found it most delicious and an excellent thirst-quencher. In taste it suggests a finely flavored black raspberry and is about two inches in diameter. The forest grows on the seaward side of the island chiefly, where there is fresh water at no great depth (see pp. 90, 91).

Other desert vegetation grows here in exceptional luxuriance. One of the most striking species is a wild cotton, found in some of the canyons; it has a bright yellow flower, but very little "wool."

In the hottest part of the interior of Santa Margarita Island we captured a desert iguana, a species of lizard which tucks its fore legs against its chest and, with tail high in the air, runs with the speed of a race horse. It was so hot from the sands that it could scarcely be

Photograph by Neil M. Judd

EXCAVATED SOUTHEAST SECTION OF PUEBLO BONITO AT THE CLOSE OF THE 1922 SEASON, SEEN FROM THE NORTH CLIFF OF CHACO CANYON

The National Geographic Society Expedition camp is seen at the upper right. The excavated eastern section of Pueblo Bonito, at the close of the 1922 season, disclosed an orderly arrangement of rectangular dwellings and round ceremonial rooms. Note the men at the right and the steel dump cars that conveyed the débris to the arroyo.

held in the hand, yet it seemed to suffer no discomfiture whatsoever.

The greater portion of these islands is steep and rocky. On Santa Margarita is a considerable quantity of magnesite, which during the World War was gathered and shipped for use in the iron and steel industry; but operation ceased when the urgent need for the material passed.

Magnesite is scattered far and wide in this region, in the form of nodules.

From Cedros and the San Benito Islands southward there is evidence of a general subsidence. Marine shells were found at elevations up to 50 feet and in great abundance at many places, yet there was no evidence of an old or long-continued beach-line. It would seem that this entire region has been "soused" beneath the sea for a short time not very long ago.

Farther south the land went under to a much greater depth, because terraces of shells have been found at elevations of more than 1,000 feet. Certainly the geological changes of the region have been most sudden and violent in character.

No doubt they have had a profound influence upon the present distribution of the animals and plants of the region.

PUEBLO BONITO, THE ANCIENT*

The National Geographic Society's Third Expedition to the Southwest Seeks to Read in the Rings of Trees the Secret of the Age of Ruins

By Neil M. Judd

Leader of the National Geographic Society's Pueblo Bonito Expeditions

THE visitor to Pueblo Bonito invariably asks, first of all, How old is the ruin? And it is precisely this question, unfortunately, which remains the most difficult to answer.

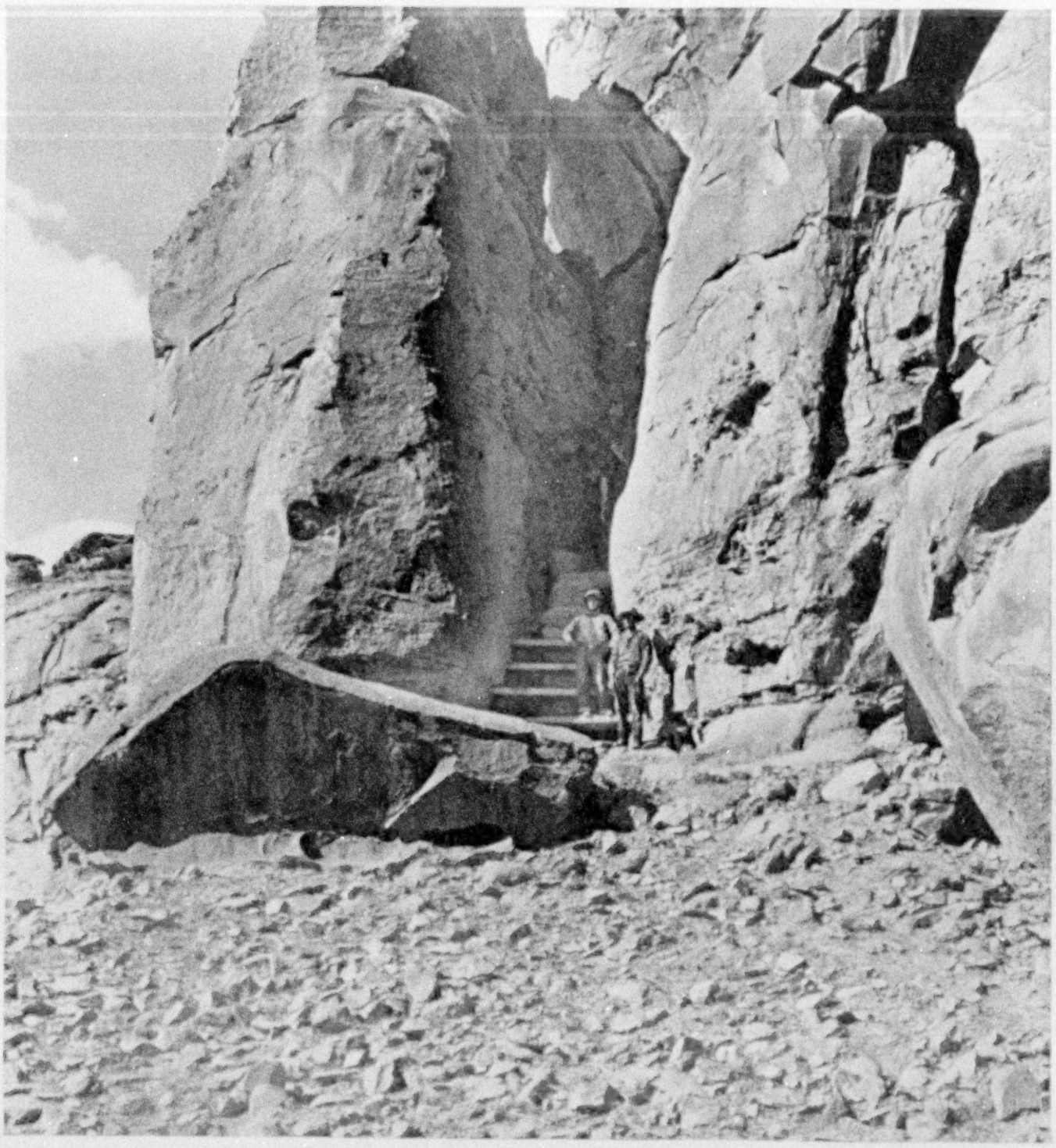
It is possible to identify many of the antiquities recovered and to explain the purposes for which they were originally designed; it is possible, and with reasonable accuracy, to sketch the picturesque life that once brightened these now drab walls of stone and clay and made the "Beautiful Village" an objective for venturesome merchants, with their wares from places so distant, even, as the valleys of central Mexico; it is possible to read from the strata of silt which have built up the valley floor something of the struggle waged by these ancient agriculturists against the overwhelming forces of Nature in desert surroundings; but it is not yet possible, and may never be, to count the years that have passed since that struggle was lost and the once proud Bonitians moved on, perhaps with heavy hearts, to greener hillsides and happier homes elsewhere.

* See the announcement of the Pueblo Bonito Expedition in the National Geographic Magazine for June, 1921, and the account of the 1921 Expedition in the issue for March, 1922. The third Expedition left Washington for Pueblo Bonito May 1, 1923.

THE SECRET OF AGE IS WELL GUARDED

Pueblo Bonito guards her age well! The casual observer would unhesitatingly say that no great period of time could have elapsed since this prehistoric apartment-house was abandoned; that walls of mere mud and stone could not have stood against the elements for more than a relatively few years.

Such superficial opinions fall by the way, however, when the explorer turns his microscope of inquiry upon the ancient structure. Then, and only then, are the evidences of considerable antiquity revealed—archaic pottery and other utensils peculiar only to the prehistoric Pueblo peoples of the southwestern United States; utter lack of any object commonly associated with European civilization and,



Photograph by Neil M. Judd

ANCIENT STAIRWAY LEADING TO PUEBLO ALTO, ON THE CLIFF ABOVE PUEBLO BONITO

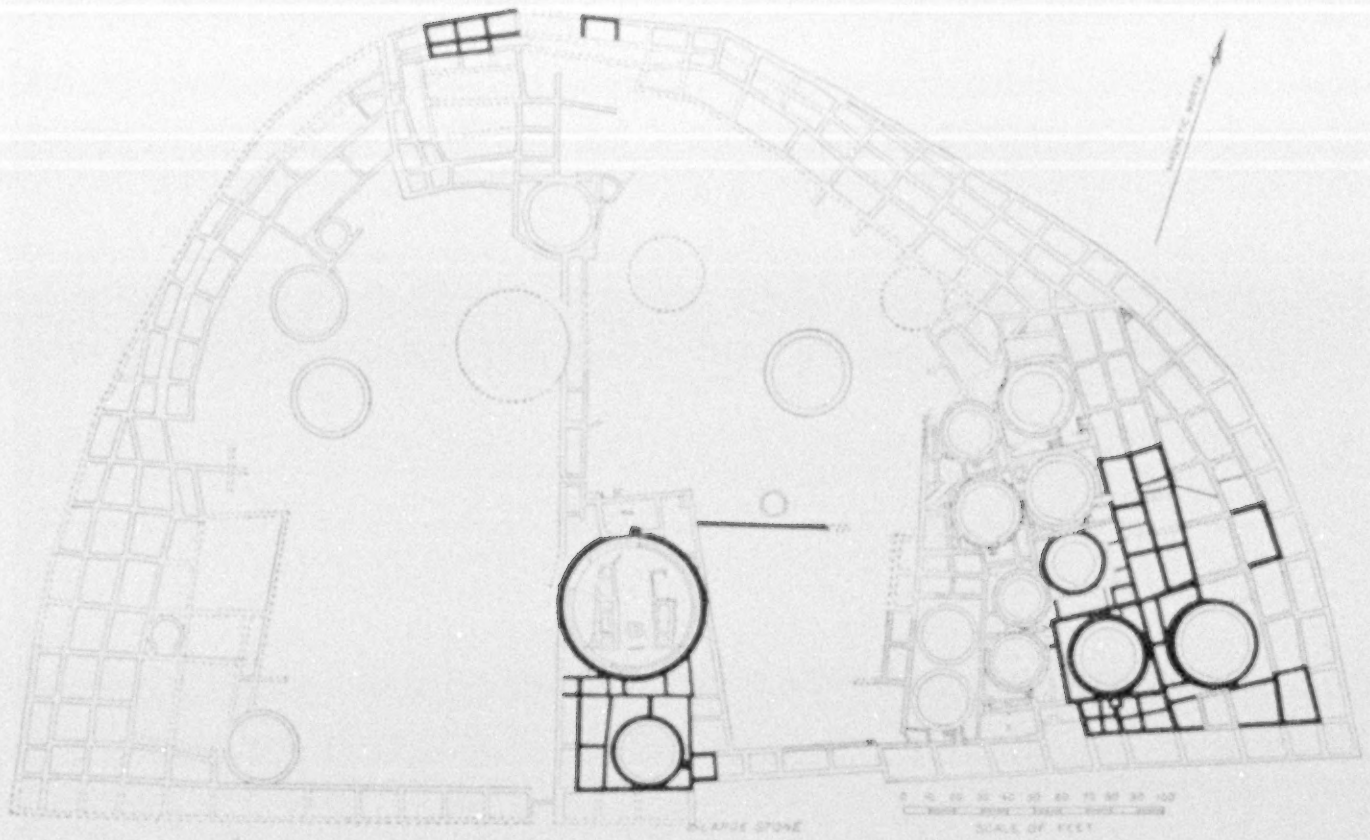
The planks at the foot occupy deep grooves in which the Bonitians had placed similar timbers, hewn by stone axes. The ancient Bonitians reached the top of the north canyon wall through a narrow crack in which they had placed broad wooden steps. A visiting member of The Society supplied new timbers, the old stairway has been restored, and the ascent may now be made without danger.

most convincing of all, the vast depth of wind-blown sand and other débris that has accumulated in and about the building since it was deserted.

During those turbulent 16th century years when the Aztec and other Mexican tribes were feeling the merciless force of the Conquest, the Spaniards heard recurrent tales of terraced villages far to the north—villages whose streets were paved with gold and whose doorways were studded with precious stones. There were seven of these wondrous cities, all ruled by a single super-chief or lord; their reputed fabulous wealth proved irresistible to the conquistadores.

SEARCHING FOR THE "SEVEN CITIES OF CIBOLA"

Late in March, 1539, Fray Marcos di Niza set out in search of these mysterious villages and when he came finally within



From original drawing by Neil M. Judd

GROUND PLAN OF PUEBLO BONITO SHOWING THE PROGRESS OF NATIONAL GEOGRAPHIC SOCIETY EXCAVATIONS

The solid black lines indicate the extent of The Society's 1921 explorations, and in hachured lines the excavations of 1922. Traces of earlier dwellings found beneath the floors of Pueblo Bonito are not shown. In the round kivas secret ceremonies were held and preparations made for the public dances in the two open courts.

sight of the Zuñi pueblos and their cultivated fields he believed he had found the "Seven Cities of Cibola" and hastened back to Mexico to confirm the native recitals and even enlarge upon them.

The conquest of this New Spain, our own Southwest, began almost immediately and has continued ever since.

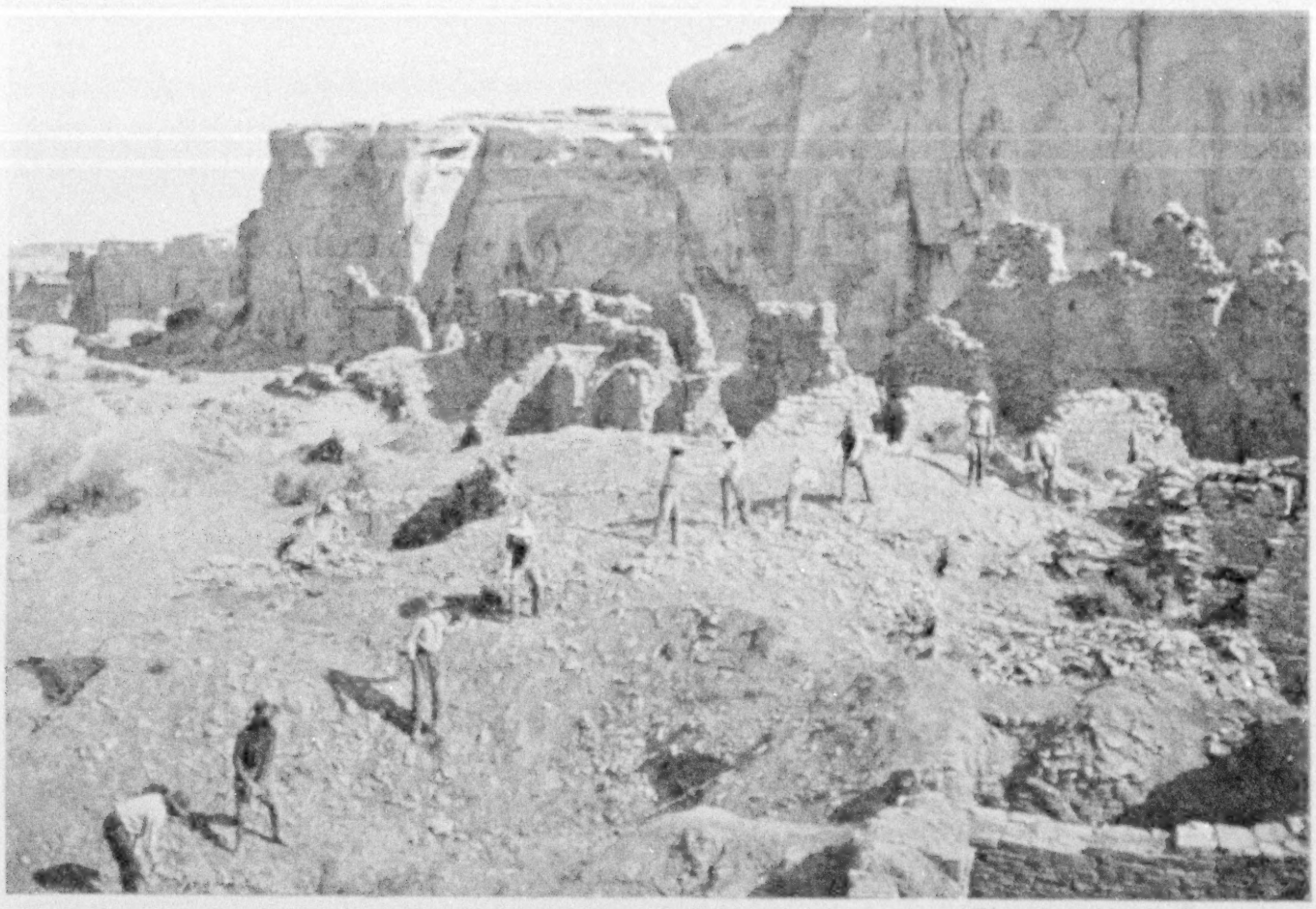
Although but little doubt now remains that the Mexican Indians had the Zuñi towns in mind, there are legitimate reasons for believing their tradition of the seven northern cities was an old one whose origin lay in glittering stories of Pueblo Bonito and its neighboring villages—tales brought back by parrot venders from lower Tamaulipas or even Oaxaca.

Coronado and his mailed followers overlooked but little—they boldly penetrated east, north, and west into unknown desert regions—but no convincing record has yet been found in their journeys that they saw, or even heard of, the marvelous ruined settlements of Chaco Canyon, in northwestern New Mexico.

We must infer, therefore, that the noncommittal Zuñi and other sedentary peoples subjugated by the strange "white gods" had either forgotten or chose to conceal from the Spaniards all knowledge of the incomparable prehistoric pueblos of the Chaco. Their history is as yet unwritten; their decline and ultimate abandonment had occurred, no doubt, long before the venturous Norse paddled their miniature vessels to the discovery of America.

BONITIANS HAD NO METHODS OF RECORDING TIME

Archeologists studying the pottery and other cultural remains, geologists examining the valley deposits and eroded cliffs, dendrologists peering into the lifelong secrets of dead and dying trees, have each, working independently along definite lines of inquiry, estimated the abandonment of Pueblo Bonito as about 1,000 years ago. But this figure, although reached after careful consideration of certain material facts, is a conjecture



Photograph by Neil M. Judd

BEGINNING EXCAVATION

Before digging operations began, the usable stones from fallen walls were gathered and passed to a central point and there stored until required in repair work. Holes torn by vandals must be mended to prevent early collapse of the higher walls in Pueblo Bonito, with their incomparable masonry. Compare this view with that on page 103, which shows the same area after exploration.

merely. It fails to answer, absolutely, the question as to the age of Pueblo Bonito.

The Bonitians possessed no method of recording time that can be correlated with our own system of time measurement; they had evolved no elaborate calendar, such as had the Maya of Central America.* When circumstances urged them forth, they closed the doors to their dwellings and pushed out across the open country to regions as yet undetermined. With the passing of the centuries, their great community house became a ruin; as such we find it to-day.

Although the exact date when Pueblo Bonito was first established and the year when it was finally abandoned remain, for the present at least, unsolved problems, there is a dim hope that these points, these all-absorbing questions, may eventually be answerable.

* See "The Foremost Intellectual Achievement of Ancient America," by Sylvanus Griswold Morley, in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1922.

Within the past decade archeological investigations elsewhere in the Southwest have resulted in a system of relative dating through pottery sequence—the comparison of different types of pottery vessels; but this method, useful as it is, only gives us the approximate age of any given ruin in relation to other ancient structures of similar characteristics.

TIMBERS MAY PROVE KEY TO MYSTERY OF THE AGE OF RUINS

Relative dates are not wholly satisfactory, even to the archeologist, and they are much less so to the layman. It remains to be determined, therefore, whether any other possible means may exist for correlating the chronology of this prehistoric culture with that of our own civilization. Such a means is now being sought by the National Geographic Society's Pueblo Bonito Expedition and by a very novel method.

The oldest living things in America are its big trees, the sequoias of the Sierra

Photograph by Neil M. Judd

INDIANS STANDING AT NORTHEAST CORNER OF ONE OF THE PUEBLO BONITO KIVAS

The mud plaster still adheres to some of the inner walls (see also page 102).

Nevada.* The pines and junipers of Arizona and New Mexico are much younger than the sequoias; but, like the latter, they are older than any other living thing in their own neighborhood. Some of these upland trees are between 400 and 500 years of age, and it is not at all improbable that still older ones may be found.

The life history of almost every tree is revealed by its own cross-section, each year's growth being recorded by a new ring. If any given year has been one of scanty rainfall, the particular ring for that year will be relatively thin; and, conversely, if the rainfall has been abundant, there will be a corresponding increase in the thickness of the annual ring.

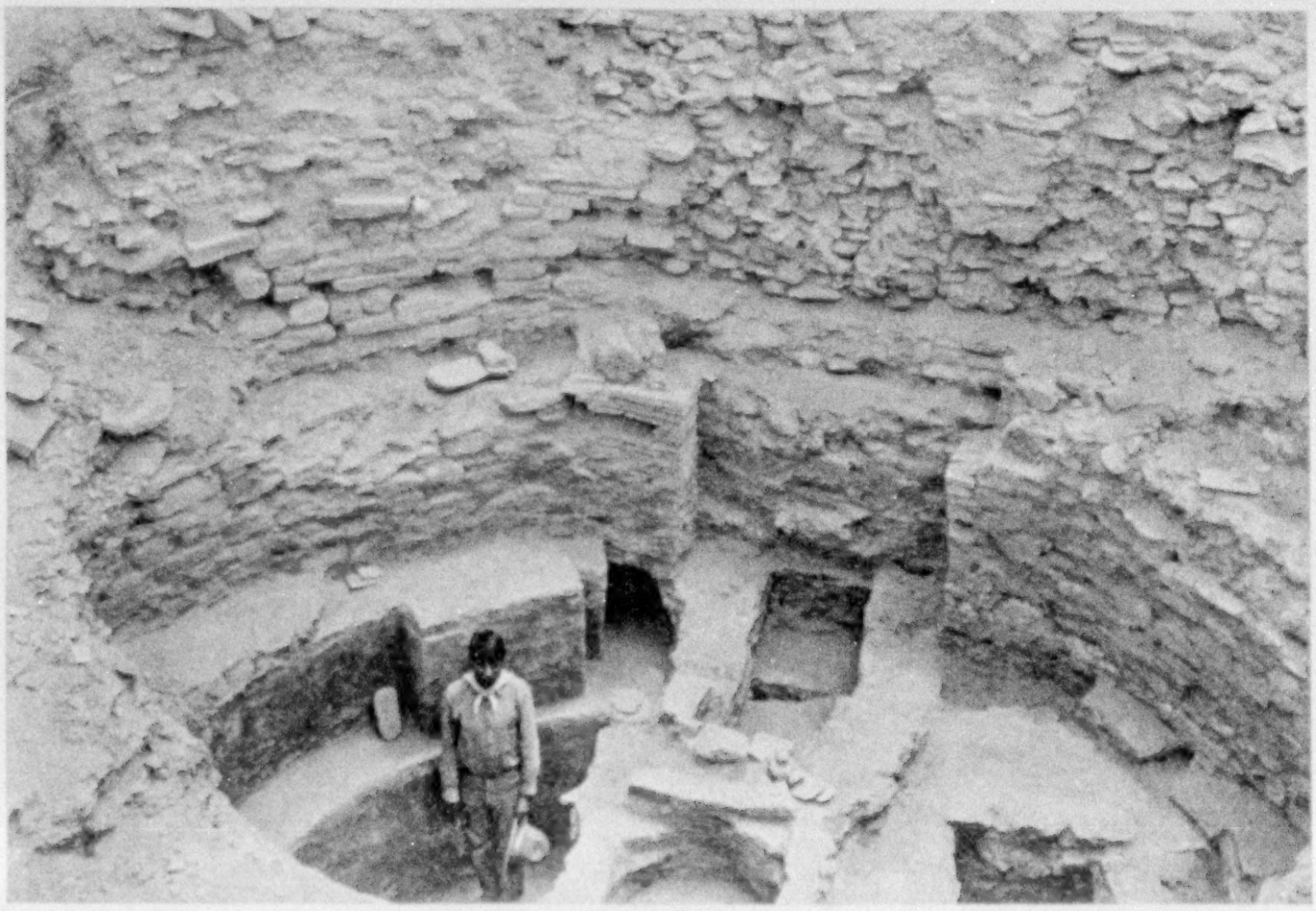
Periods of drought or excessive moisture, it has been learned, tend to repeat themselves at fairly regular intervals, resulting thus in a more or less orderly sequence of thick and thin annual rings which do not vary, to any marked degree, in all the trees of any one district.

Certain of these ring series possess individual features that quickly identify them, no matter in what locality they may be found, and these are naturally utilized by the investigator as "keys" to the problem he is seeking to solve. And what is true of living trees is likewise true of dead

* See the NATIONAL GEOGRAPHIC MAGAZINE for January, 1917, and July, 1921.

PART OF THE EXCAVATED SECTION OF PUEBLO BONITO AT THE CLOSE OF 1922 SEASON

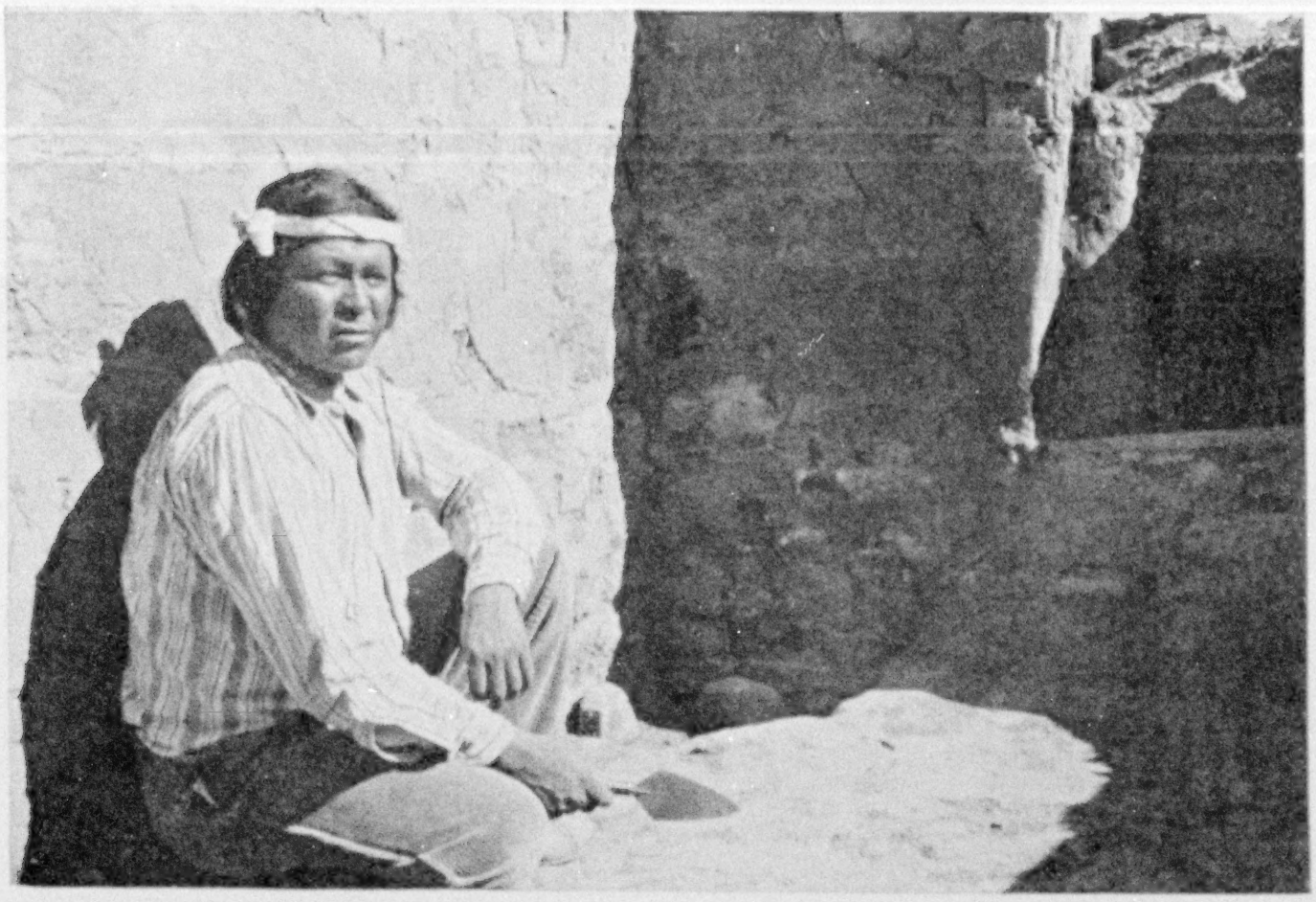
When several trainloads of building stone, adobe, plaster, and wind-blown sand had been carted away and the frayed edges of walls repaired to prevent rain water running into the empty rooms, Pueblo Bonito began to assume definite form and character.



Photographs by Neil M. Judd

A FIREPLACE, CEREMONIAL ENTRANCE, SOUTH BENCH RECESS AT PUEBLO BONITO

Beneath the floor of this shattered kiva, or ceremonial room, of pure Chaco Canyon type, lay the partially razed walls of an earlier kiva of entirely different design. The Indian boy stands on the floor of the earlier room; his head is at the floor level of the later structure.



Photograph by Neil M. Judd

ONE OF THE FEW FIREPLACES DISCOVERED WITHIN THE ROOMS OF PUEBLO BONITO IS DIVIDED BY THE SHADOW ABOVE THE WORKMAN'S TROWEL

The Bonitian housewife did the family cooking in the village court or on the roof of her neighbor's home.

trees, and beams or roofing timbers from prehistoric ruins, like Pueblo Bonito.

From the foregoing it will be obvious that if any overlapping series of annual rings can be discovered—that is, if a given sequence of rings can be found both in a beam from Pueblo Bonito and in a tree still living—it will be possible to date the former with reasonable exactness.

Such a direct connection, however, with no intervening links in our time chain from the beams of prehistoric Pueblo Bonito to the living trees of northern New Mexico, is rather beyond the range of possibilities; the explorer's task is rarely quite so easy as that.

TRYING TO BRIDGE A TIME GAP

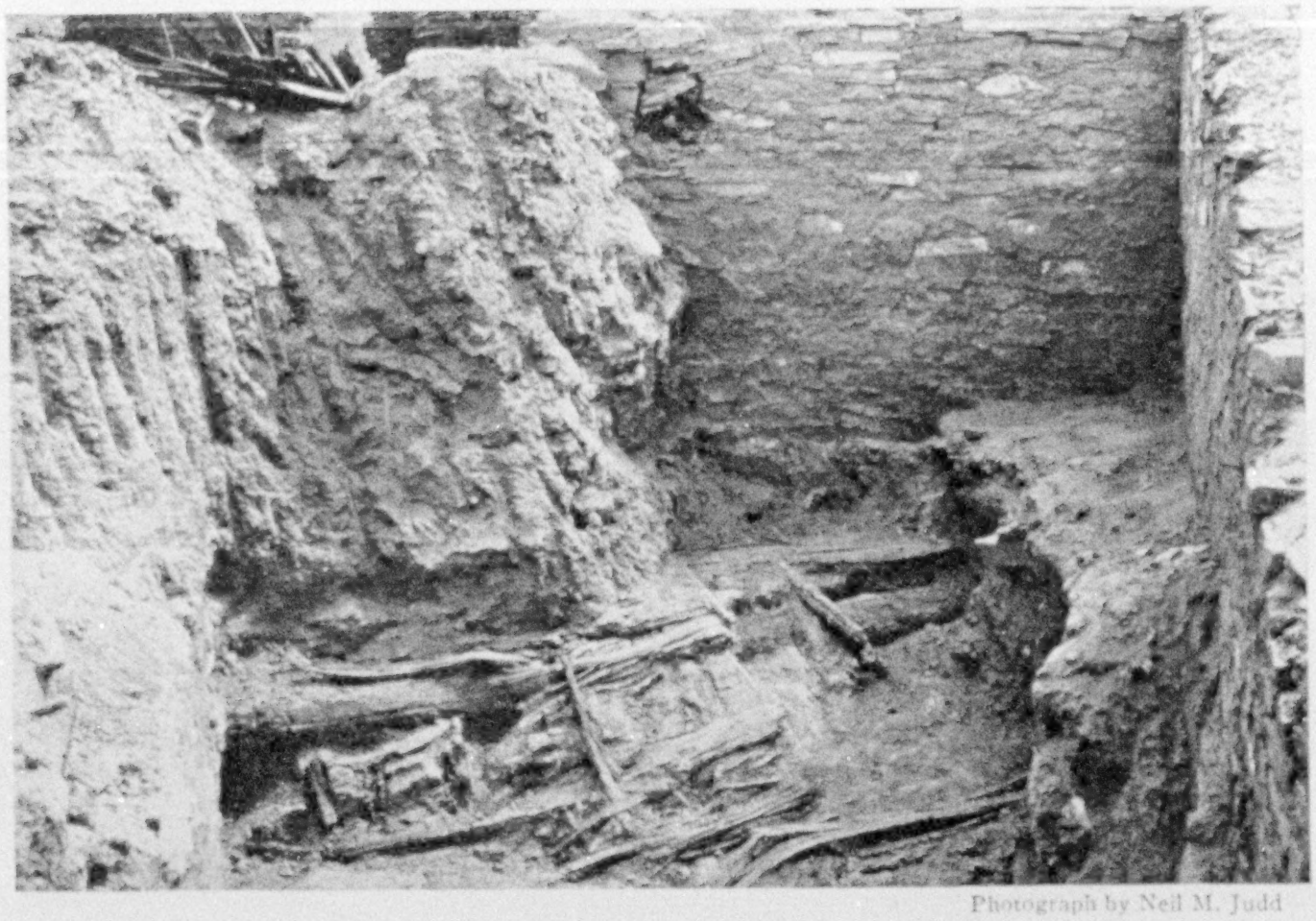
It seems necessary, therefore, in the present case, to find a "connecting link" in this time chain, and that is the especial object of a subsidiary expedition recently authorized by the Research Committee of the National Geographic Society in connection with the exploration of Pueblo Bonito, now in its third year.

This party will seek out the oldest living trees in the plateau States; it will seek dead pines and stumps which have been buried in mesa canyons, hoping through them to bridge the gap that now guards the age of the great ruin. And, with equal confidence, the party will search Pueblo villages still inhabited for roof beams that may have been cut several centuries ago.

Prior to the conquest of 1540, Pueblo artisans felled with stone axes the timbers that went into the construction of their terraced homes. So great was the labor involved in cutting and transporting these logs that they came to be looked upon as prized possessions and were frequently carried along when family groups abandoned one village in favor of another, newly established.

Because of this known practice it is not unlikely that beams still utilized at Zuñi, Walpi, and other pueblos reconstructed at the close of the 17th century were salvaged from dwellings destroyed following the "Pueblo rebellion" of 1680.

Such timbers, if indeed they exist, will



Photograph by Neil M. Judd

REMAINS OF THE CEILING OF ONE OF THE ROOMS AND WALL SUPPORTS OF PUEBLO BONITO

The logs, split cedar, and adobe mud that formed the upper floors in Pueblo Bonito have mostly disappeared, but such beams as are found may help to determine the age of the ruin when their annual ring growth is studied (see text, pages 103 and 105).

surely lessen the gap that now separates the ring-growth series of Pueblo Bonito beams from that in living pines on the higher mesas of Arizona and New Mexico.

Cross-sections from forty-nine timbers unearthed during the explorations of 1921 and 1922 have been examined by Dr. A. E. Douglass, of the University of Arizona, with very instructive results. These beams, taken from the eastern portion of Pueblo Bonito, all seem to have been cut within a period of twelve years.

Some timbers exposed in the northwestern quarter of the ruin, however, were cut several years earlier, thus corroborating the archeological evidence previously presented.*

Dr. Douglass tells us, also, that most of these ceiling beams were felled in winter or very late autumn. It may be, therefore, that the ancient Bonitians had periodic logging parties; that, after the harvests had been gathered and safely stored away in the interior rooms of the village, groups of the menfolk set out for the timbered ridges in search of logs with which to roof new dwellings.

Lacking beasts of burden, they dragged or carried on their backs the large beams we find to-day in Pueblo Bonito and Pueblo del Arroyo.

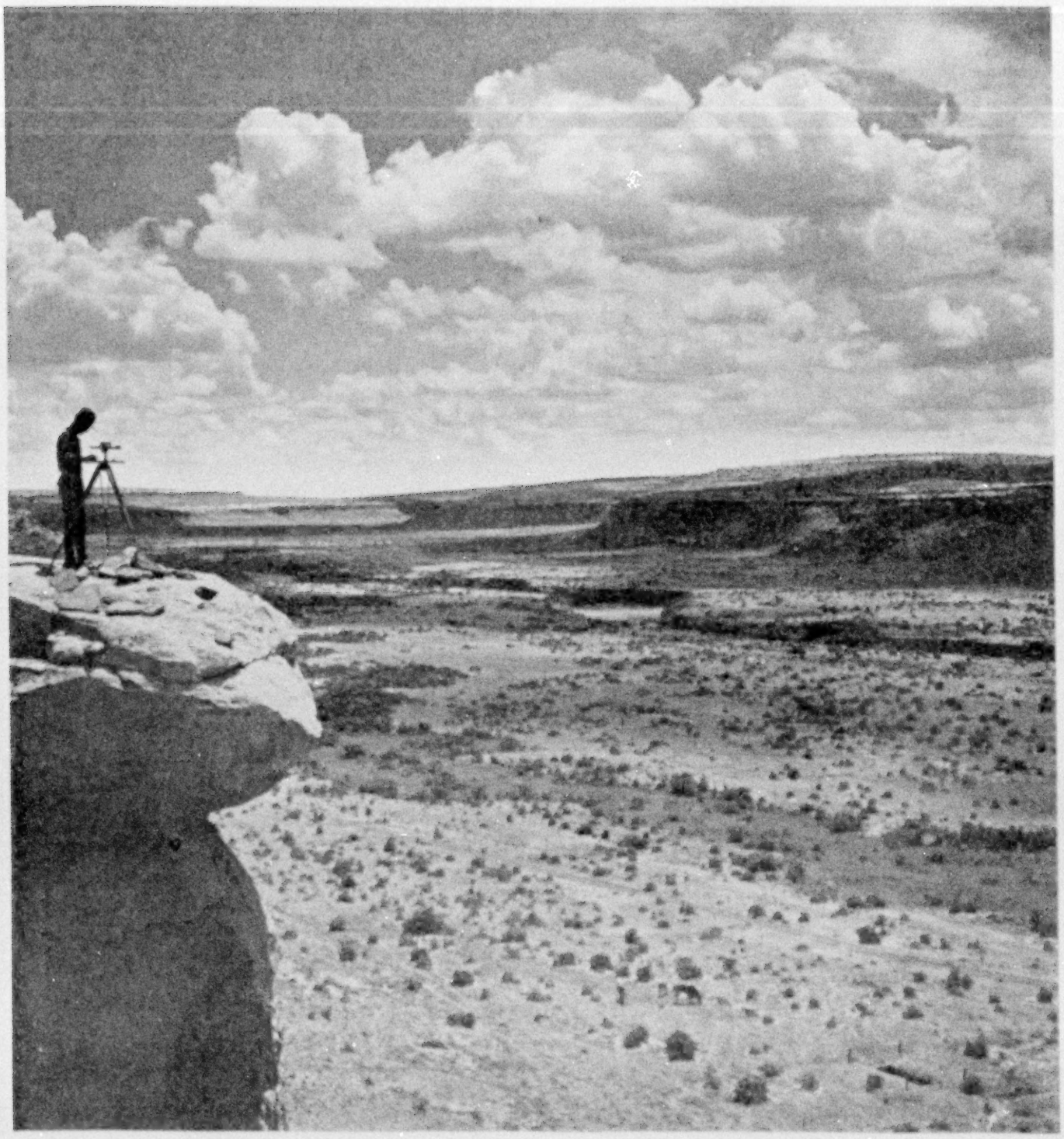
DID FORESTS ONCE GROW IN NOW DESERT CANYONS?

What has happened out there in the desert canyons of New Mexico during the past thousand years?

Were former forests exhausted in the construction of the "Beautiful Village," or has the climate so changed with the passing years as to have blotted out these forests and to have checked all subsequent attempts of Nature to replace the trees that were?

The fact remains that no timber comparable in size to the ancient beams grows to-day within 40 miles of Pueblo

* See the NATIONAL GEOGRAPHIC MAGAZINE for March, 1922.



Photograph by Neil M. Judd

ON THE CLIFF ABOVE PUEBLO BONITO, MAPPING CHACO CANYON

It was a trying task to prepare an accurate map of Chaco Canyon, for down on the valley floor the heat was intense and up on the broken rim rock tireless winds threatened to brush both surveyor and transit over the edge. Capt. R. P. Anderson and two Indian flagmen completed the undertaking, nevertheless. For comparison, note the size of the horses in the right foreground.

Bonito, and that a period of unknown length has elapsed between the cutting of the last roof-beams in Pueblo Bonito and the sprouting of the seedlings which have since become the oldest known living trees of the Arizona and New Mexico plateaus.

Exploration of Pueblo Bonito has disclosed other evidence which points to the great antiquity of the village. The partially razed walls of earlier structures lie beneath the foundations of nearly every room thus far excavated; these earlier dwellings appear to have been erected on a knoll or slight elevation which has long since lost its identity, owing to the millions of tons of blown sand and water-deposited silt that have gradually built up the level floor of Chaco Canyon since the ancient towns were occupied.

Human habitations vastly older than Pueblo Bonito—houses covered by as much as 12 feet of clay and sand—within

a few moments' walk of the great ruin have been discovered and explored by the Expedition.

These remains, together with deeply buried layers of potsherds, charcoal and other camp refuse exposed by cutting of the arroyo, illustrate the fact that Pueblo Bonito, old as it unquestionably is, was not established until long after primitive man had selected this isolated desert canyon as a desirable spot in which to locate his home and family.

PUEBLO BONITO WAS A COÖPERATIVE SETTLEMENT

The explorations of 1922 emphasized even more strongly than did those of the previous summer the fact that Pueblo Bonito is a monument to the coöperative efforts of peoples physically related, though culturally distinct, who were drawn together, through mutuality of interest, from widely separated localities.

Cliff-dwellers from the picturesque cave villages of Colorado's Mesa Verde were welcomed by the Bonitians, together with migrating clans from the valley pueblos that once bordered the Little Colorado River in Arizona. Relics peculiar to each of these distinctive cultures abound in Pueblo Bonito, whose characteristic arts were influenced, though not supplanted, by such foreign elements.

Many mysteries in connection with Pueblo Bonito remain still to be solved. One of the most tantalizing of these has to do with the manner of disposing of its dead, on which depends certain fundamental truths.

Excepting two discarded wisdom teeth and the body of an infant, buried in the refuse which filled an abandoned room, no skeletal material has yet been found by the Expedition, although hundreds of individuals must certainly have died during the long-continued occupancy of the village.

THE PROBLEM OF THE WATER SUPPLY

Another puzzling problem concerns the source and extent of the ancient water supply. Primitive man can exist very well on a quart or two of water a day for culinary purposes, but Pueblo Bonito had a thousand or more inhabitants, and other neighboring settlements were undoubtedly dependent upon the same springs or reservoirs.

The broad stairway behind the ruin may have led to sand-scoured water pockets on the cliff above, pockets that still hold water for short periods following the early spring and midsummer rains. But what seems even more likely is that once generous springs at the base of the canyon wall have since filled and been covered over with blown sand to such an extent that their exact location is no longer apparent.

Aged Navajo warriors still dwelling in Chaco Canyon insist that, as boys, they heard the old men of their tribe tell of one such spring which formerly issued from the rocks near Ysa-be-ad-ne-i (Place-where-the-rock-is-braced-up).

Explainers of the Great Mysteries, believers in self-fashioned solutions of natural phenomena though they be, the Navajo may possess more information regarding prehistoric Pueblo Bonito than it has been possible to concede heretofore, and their folklore merits our careful consideration, since it may yet prove unexpectedly helpful in solving pertinent problems which now seem well-nigh hopeless.

INDEX FOR JANUARY–JUNE, 1923, VOLUME READY

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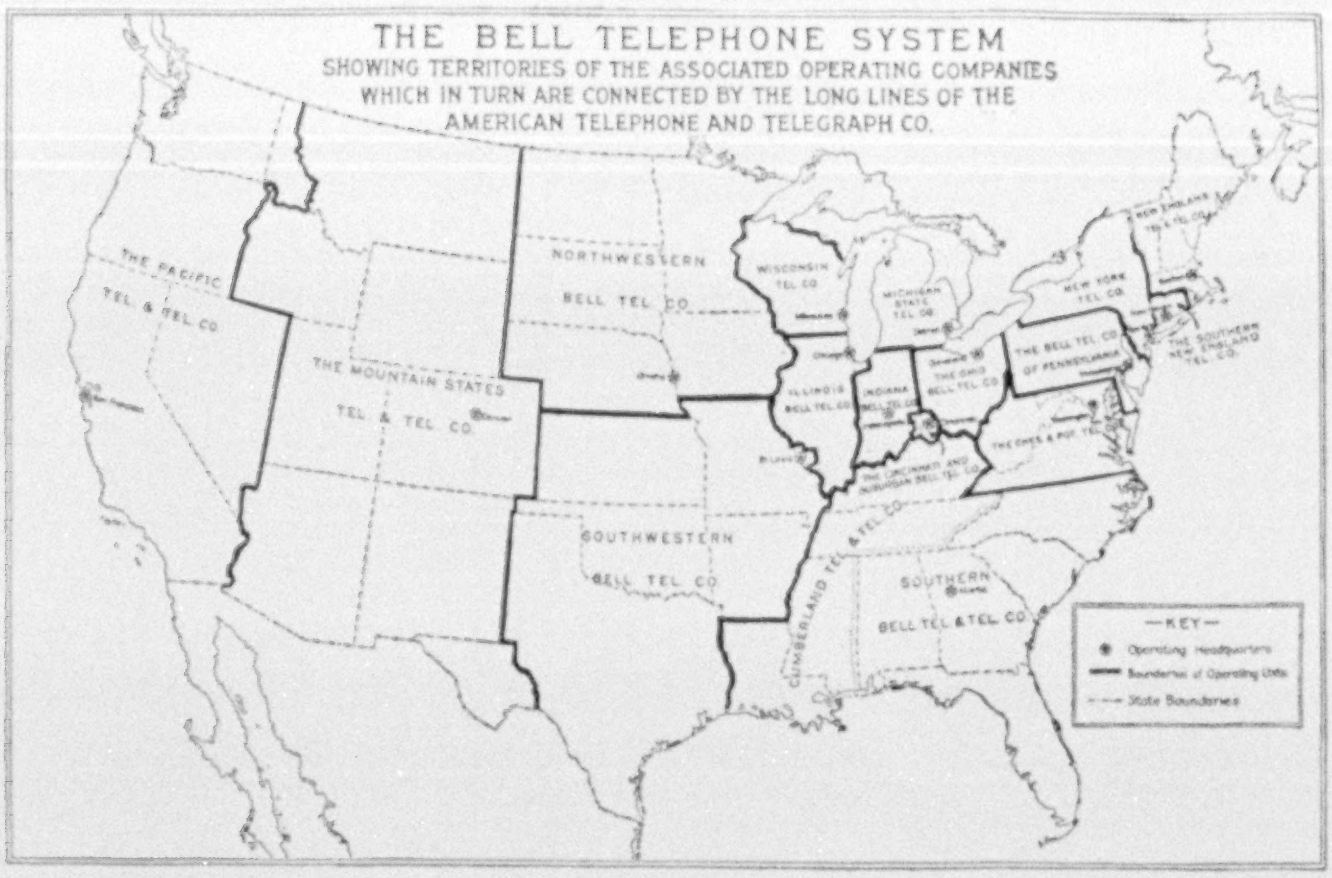

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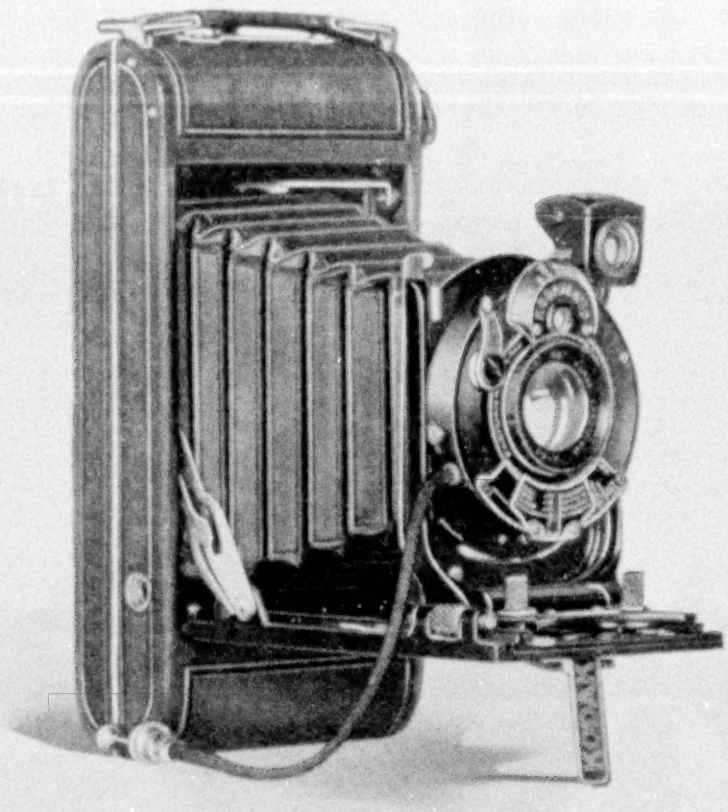

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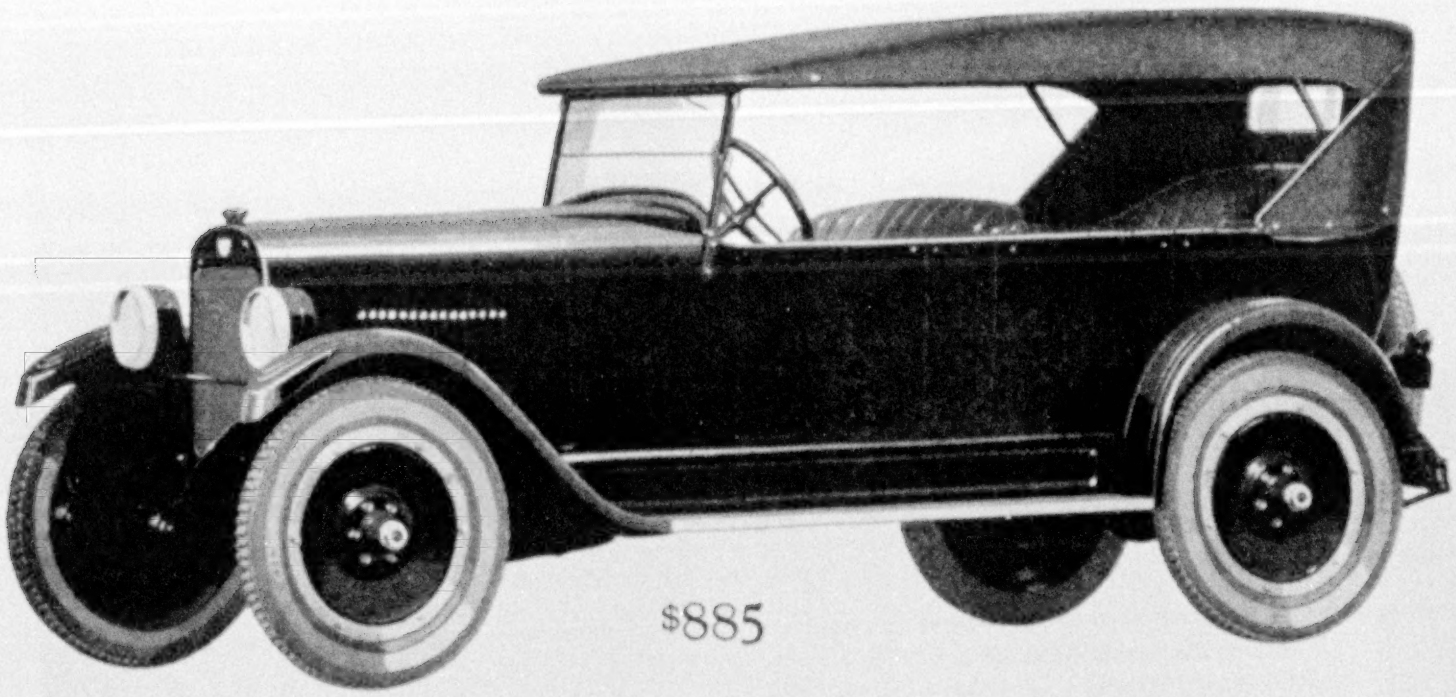

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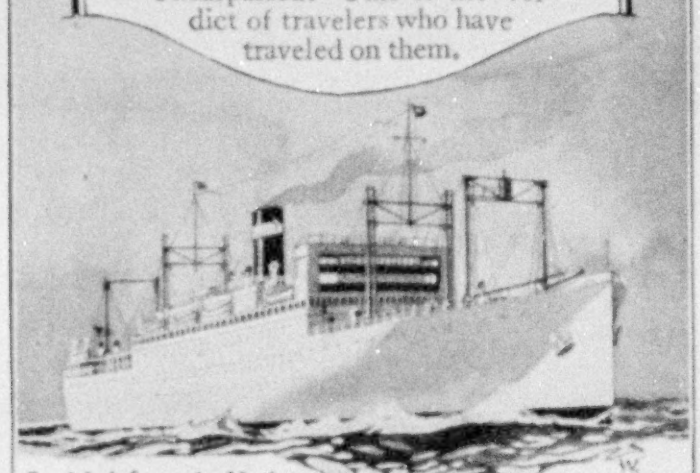

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The method is used by millions. Dentists the world over now advise it. Won't you learn how much it means to you—and yours?

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No old-time tooth paste could effectively combat it. So coated teeth were almost universal. And very few escaped the troubles caused by film.

Film holds food substance which ferments and forms acids. It holds the acids in contact with the teeth to cause decay. Germs breed by millions in it. They, with tartar, are the chief cause of pyorrhea.

Had to fight it

Tooth troubles became alarming in extent, so dental science saw the need to fight film. After much research, two ways were discovered. One acts to curdle film, one to remove it, without any harmful scouring.

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Modern research also found other things essential. So Pepsodent also multiplies the alkalinity of the saliva. That is there to neutralize mouth acids, the cause of tooth decay.

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Thus every use gives manifold power to these great natural tooth-protecting agents.

50 nations use it

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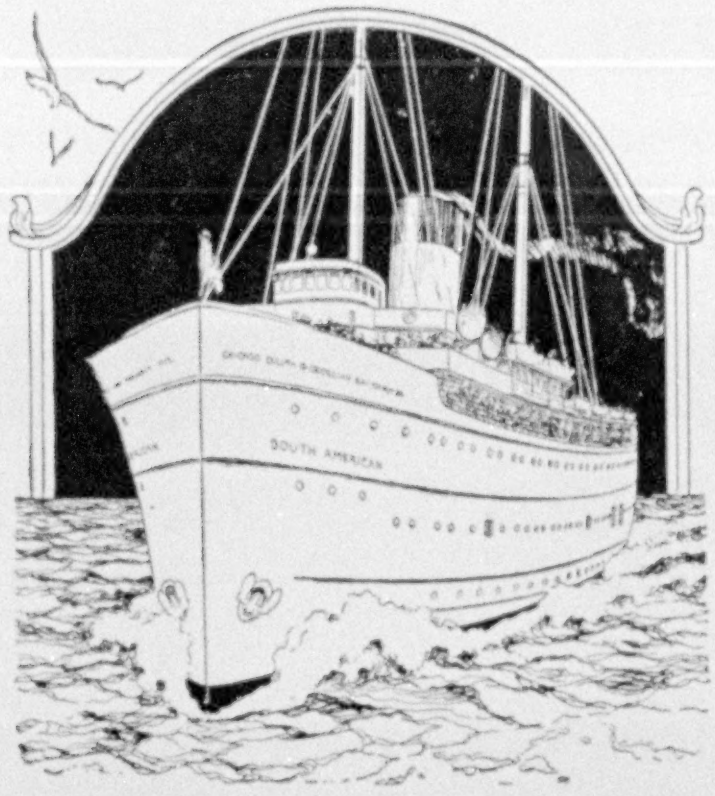

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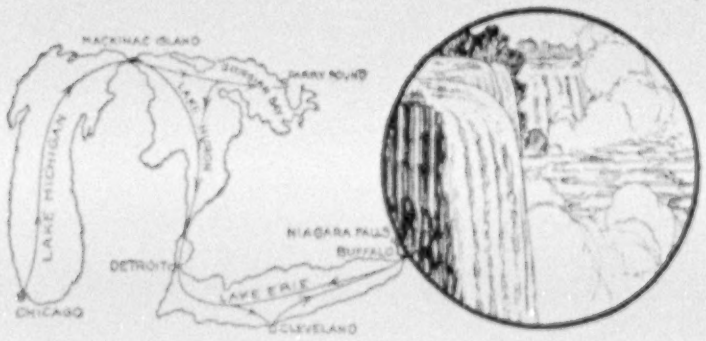

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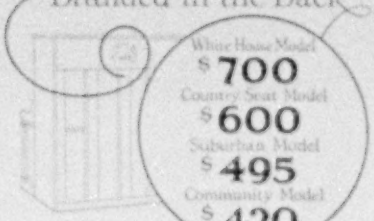

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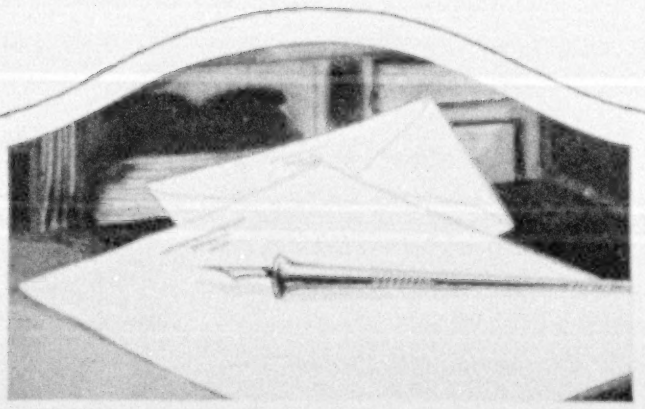

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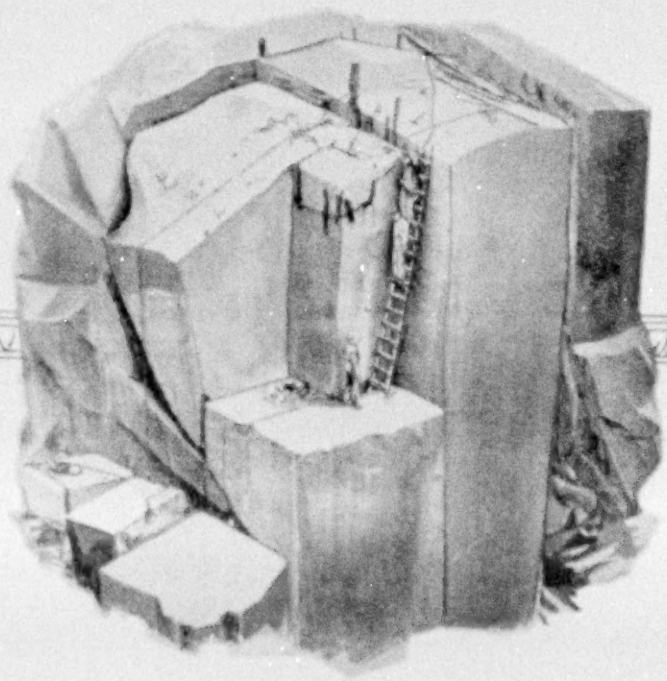

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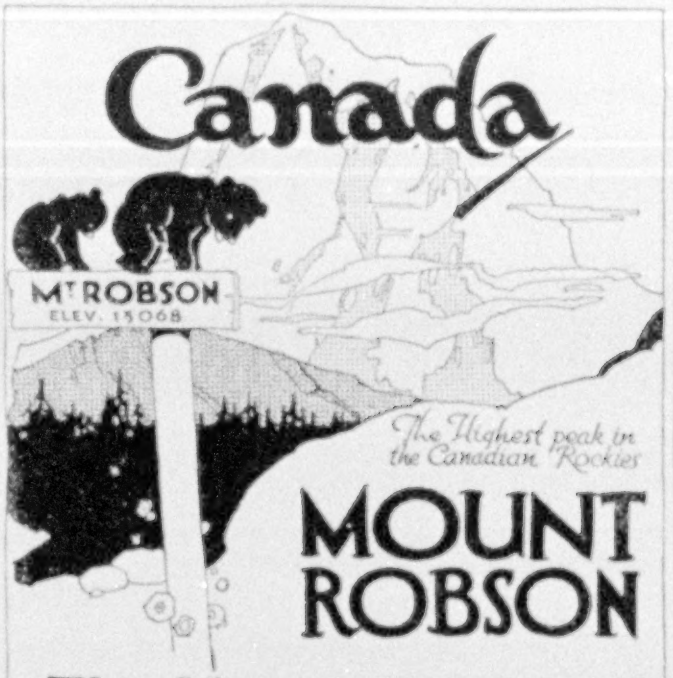

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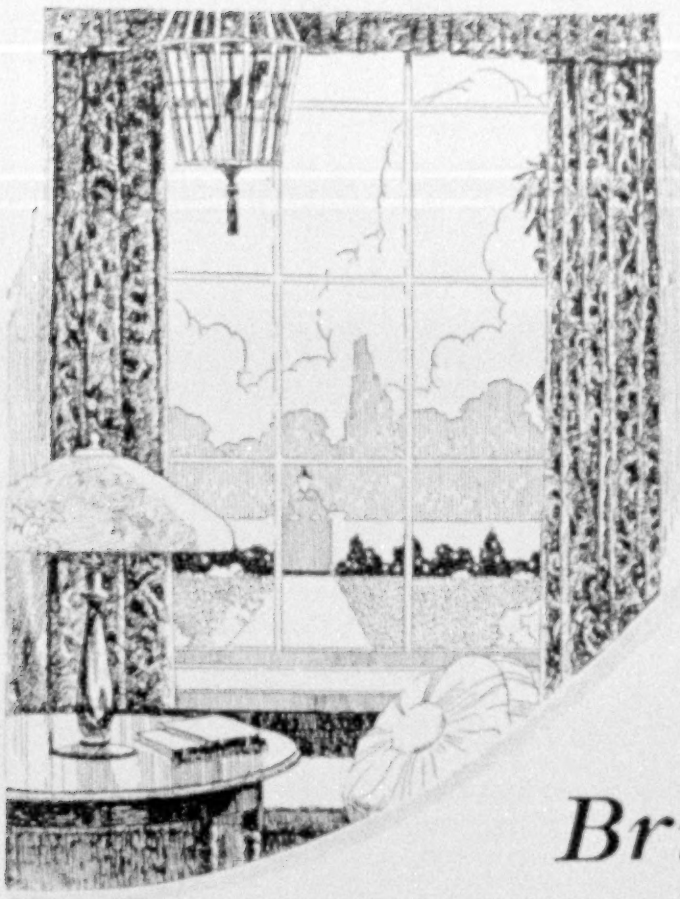

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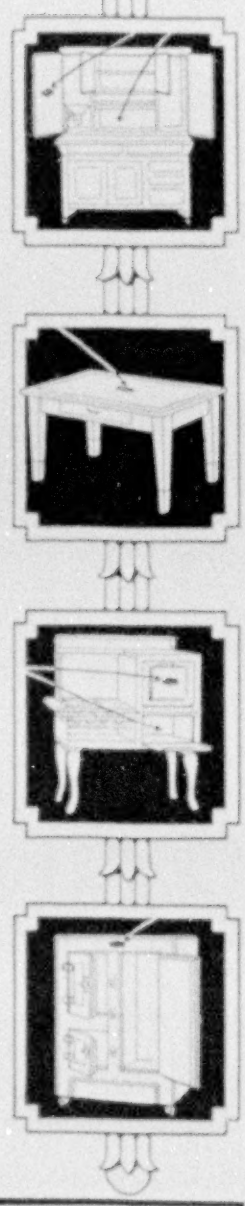

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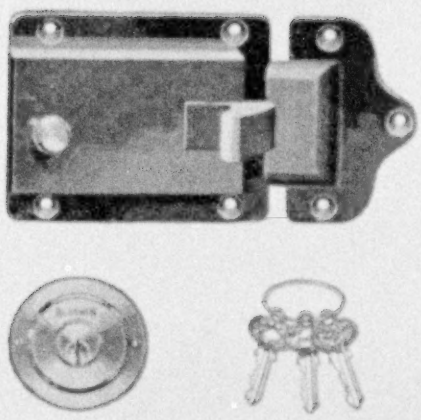
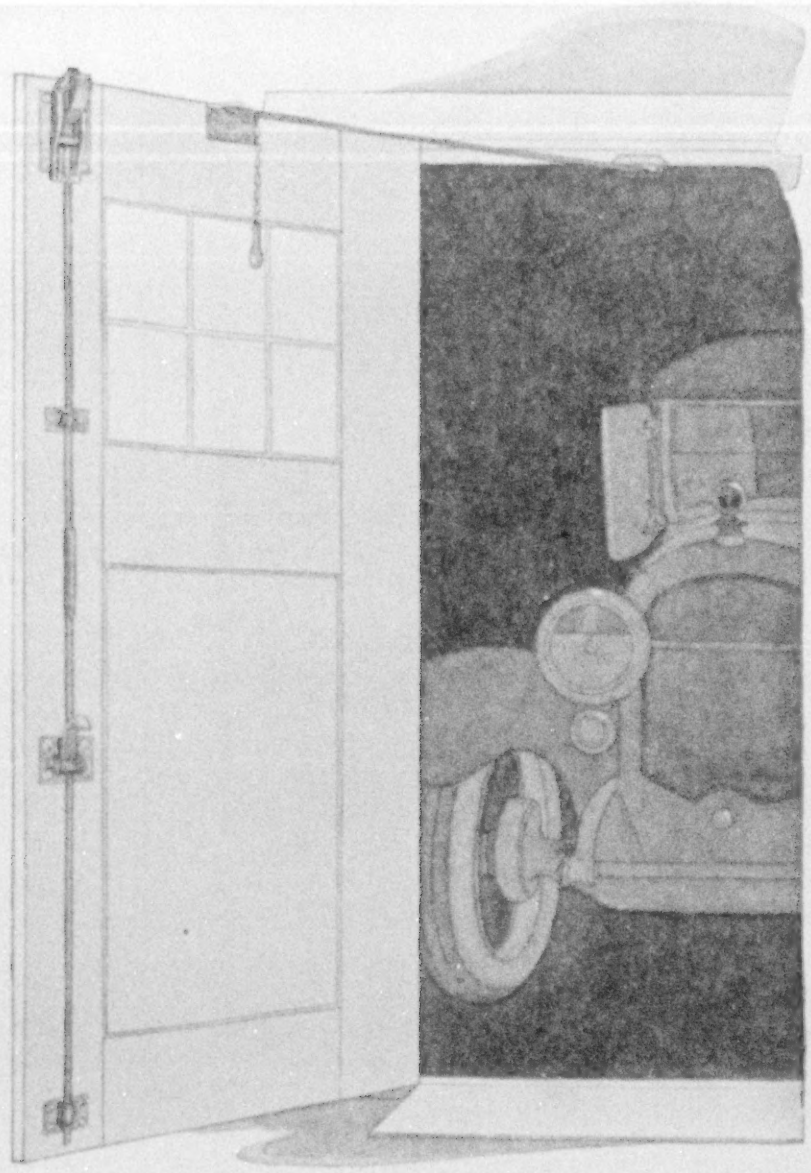


RUSSWIN Adaptable Garage Lock



RUSSWIN Automatic-Locking Bolts and Door Holders

HARDWARE for your home—and garage—should give you now, and in the years to come, smooth, perfect, trouble-free service—

the character of service that is built into every piece of hardware that bears the Russwin trade mark.

With the additional satisfaction which comes from the knowledge that Russwin Hardware is beautiful and harmonious in every detail of its design and finish.

"To Russwin-ize is to Economize"

Russell & Erwin Manufacturing Co.

The American Hardware Corporation, Successor

New York
San Francisco

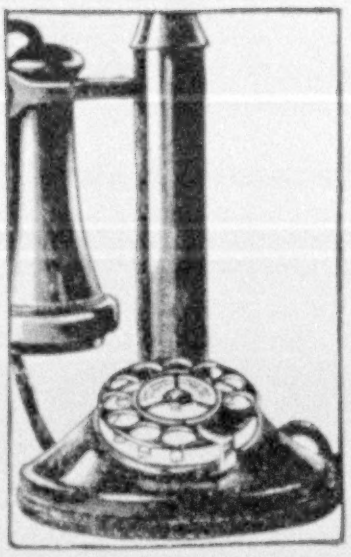
New Britain, Conn.

Chicago
London

Since 1839

RUSSWIN

DISTINCTIVE
HARDWARE



More than a private telephone exchange—the Automatic Electric Services of the P-A-X include and co-ordinate interior telephony, code call, conference, watchman's service and all other interior communication needs.

Extending the Use of the Telephone—

Get Proof of the Amazing Time and Money Saving Advantages of This Modern System of Interior Telephony

The P-A-X is similar to the Automatic Telephone equipment, being so widely adopted for city service. It augments and completes but does not supplant nor connect with the local or long distance telephone service. Over a thousand business institutions in America are daily profiting by the P-A-X. To forward-moving concerns the services of the P-A-X are obviously necessary. The facts in our book, "The Straight Line," are highly interesting to business executives. We have appended the coupon for you to detach at home as a memorandum. This book is gratis, of course.

P-A-X

TRADE MARK

THE PRIVATE AUTOMATIC EXCHANGE

Automatic Electric Company

ENGINEERS, DESIGNERS AND MANUFACTURERS OF THE AUTOMATIC TELEPHONE—IN USE THE WORLD OVER

HOME OFFICE AND FACTORY: CHICAGO, U. S. A.

Branch Offices in All Principal Cities

EXECUTIVE'S COUPON—For Complimentary Copy of the Booklet "The Straight Line." N-1

Automatic Electric Co., 947 W. Van Buren St., Chicago, Ill.

Gentlemen: Please send me "The Straight Line."

Name .....

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Name of Company .....

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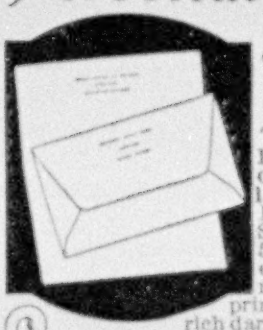
Now!

every cake in a metal soap box

Packer's Tar Soap

Personal Stationery



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A WHOLESOME and healthful "Meat Fibrine" biscuit for every size and breed. Toys want them every day, but they are equally attractive to big dogs. About 120 of these tempting crackers to the pound. Ovals make an ideal change from the steady diet of SPRATT'S Dog Cakes and Puppy Biscuits. Insist on SPRATT'S Foods for your dog's sake, and remember that the best is always the cheapest in the long run. Write for sample and send 2c for pamphlet G7 on the care and feeding of dogs, cats, birds, poultry, game, etc.

SPRATT'S PATENT, LIMITED
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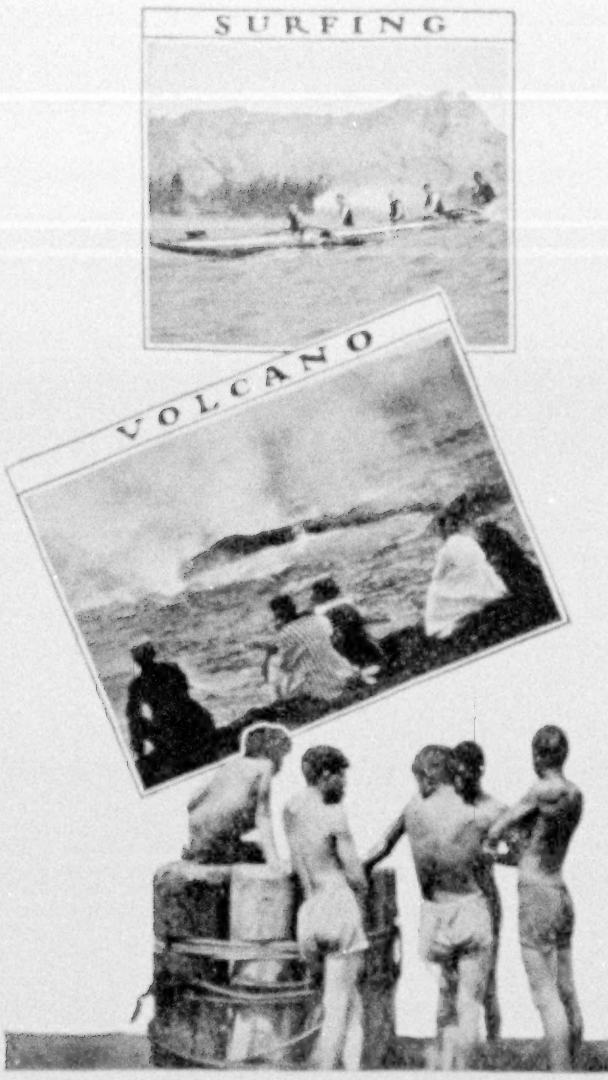

It's Spring All Summer in HAWAII

Hawaiian summers are cool. Crisp trade-winds from the Arctic assure that. Highest temperature (official U. S. Weather Bureau records) at Honolulu last summer was 85°.

Go there on your summer holiday: you'll find the great flowering trees gorgeous with bloom and luscious tropic fruits ripe and waiting to be eaten. You can make the round trip from the Pacific Coast, including 2 weeks' sightseeing, for $300. Ask your nearest railway, steamship or other travel agency for new colored booklet; or fill in, clip and mail the accompanying coupon to:

HAWAII TOURIST BUREAU
532 Monadnock Bldg., San Francisco
or 812 Fort Street, Honolulu, Hawaii, U. S. A.

Send me your free illustrated booklet on HAWAII; also the latest issue of Tourfax, containing detailed information for visitors to the Islands.

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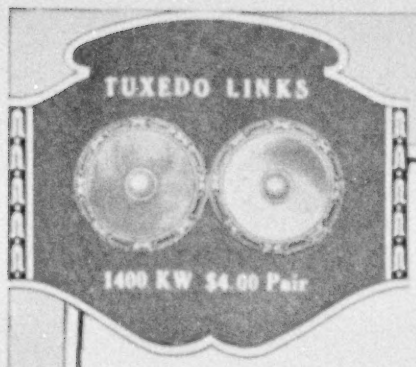

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Vacation days mean jazz. Jazz means dance. Dance means tuxedo. Tuxedo means Krementz. Be sure and take a Krementz tuxedo set with you on your vacation. At your dealers—$4.50 to $25.00.

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(Limited to 450 Guests—about Half Capacity)
By magnificent new 20,000 ton
Cunard S. S. "SCYTHIA"
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Sailing January 30, 1924, 67 Days, repeating the complete success of the 1923 similar Cruise, same steamer, visiting

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Very Low Summer fares

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The round trip costs but a trifle more than the regular one way fare.

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NEW YORK

Far Better Than a Pair of Hands

No scrubbing. No scouring. No dipping out of water. Sani-Flush cleans toilet bowls better than any other means. Faster. Cleaner. Easier.

Sprinkle a little into the bowl. Follow directions on the can. Flush! Gone are all stains, discolorations, incrustations. The bowl glistens.

Too, the hidden, unhealthful trap is cleaned—purified by Sani-Flush. All foul odors are destroyed. There is nothing like Sani-Flush. It will not harm plumbing connections.

Always keep Sani-Flush handy in the bathroom.

Sani-Flush is sold at grocery, drug, hardware, plumbing and house-furnishing stores. Price, 25c. (Canadian price, 35c; foreign price, 50c.)

THE HYGIENIC PRODUCTS CO.
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Sani-Flush

Cleans Closet Bowls Without Scouring

It happened!

He is telephoning for help—
His beautiful closed car is on fire and two members of his family are severely burned.

The disaster could have been averted.

Pyrene, used when an automobile fire *starts*, is sure protection to life and property.

Can you afford to risk your own life and your automobile, when, at a small price, you can equip your car with Pyrene and know that you are fully protected from fire dangers?

Sold by garages, hardware and electrical supply dealers

PYRENE MANUFACTURING CO.
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Necessary in every automobile

Pyrene
KILLS FIRE
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PYRENE SAVES 15% ON YOUR AUTO FIRE INSURANCE PREMIUM

PYORRHOCIDE POWDER

keeps the gums healthy

Healthy Gums

Resist pyorrhea germs

KEEPING your gums healthy is the only way to prevent pyorrhea. Pyorrhocide Powder *does* keep the gums healthy. And it aids in restoring them to health if pyorrhea has developed.

The high standing of Pyorrhocide Powder among dentists since 1908 is due to its effectiveness as a dentifrice for both the teeth and the gums. It keeps the teeth white and clean. It removes the mucoid film which hardens and forms tartar, the chief cause of pyorrhea.

See your dentist regularly—use Pyorrhocide Powder daily—and you can avoid loss of teeth from pyorrhea. The economical dollar package contains six months' supply. At all druggists and dental supply houses.

Buy a package today

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Sold by Druggists Everywhere

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It satisfies your thirst and also does you good

The delightfully refreshing "tart" that a teaspoonful of Horsford's Acid Phosphate imparts to fruit juices—or just plain water—also makes the summer drink more wholesome because of the vital PHOSPHATES it contains.

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WASHINGTON, D. C.

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WASHINGTON, D. C.

What's in your telephone

This picture, taken "behind the scenes", gives some idea of the complexity of your telephone.

To select the raw materials and refine them, to produce from them the finely-wrought coils and contacts and diaphragms, to assemble the many parts into a smooth-working and long-lasting telephone—all this calls for a manufacturing skill of high order.

Western Electric telephones are the product of fifty-four years' manufacturing experience.

Western Electric

Since 1869 Makers of Electrical Equipment

No. 4 of a series on raw materials.

FLAX
In linen paper in transmitter button.

NICKEL
Contact springs; for plating transmitter parts.

MICA
Diaphragm in transmitter button.

COAL
Carbon granules in transmitter button.

SHELLAC
Used in mouthpiece composition.

GOLD PLATINUM SILVER
Contact metal for contact points in springs.

COTTON
In covering on transmitter cords.

ZINC
In contact springs and all brass parts.

ASPHALT
One of the outside finish constituents.

LEAD
In combination with tin in solder.

TIN
In all soldered joints. (See Lead.)

ALUMINUM
Diaphragm for transmitter.

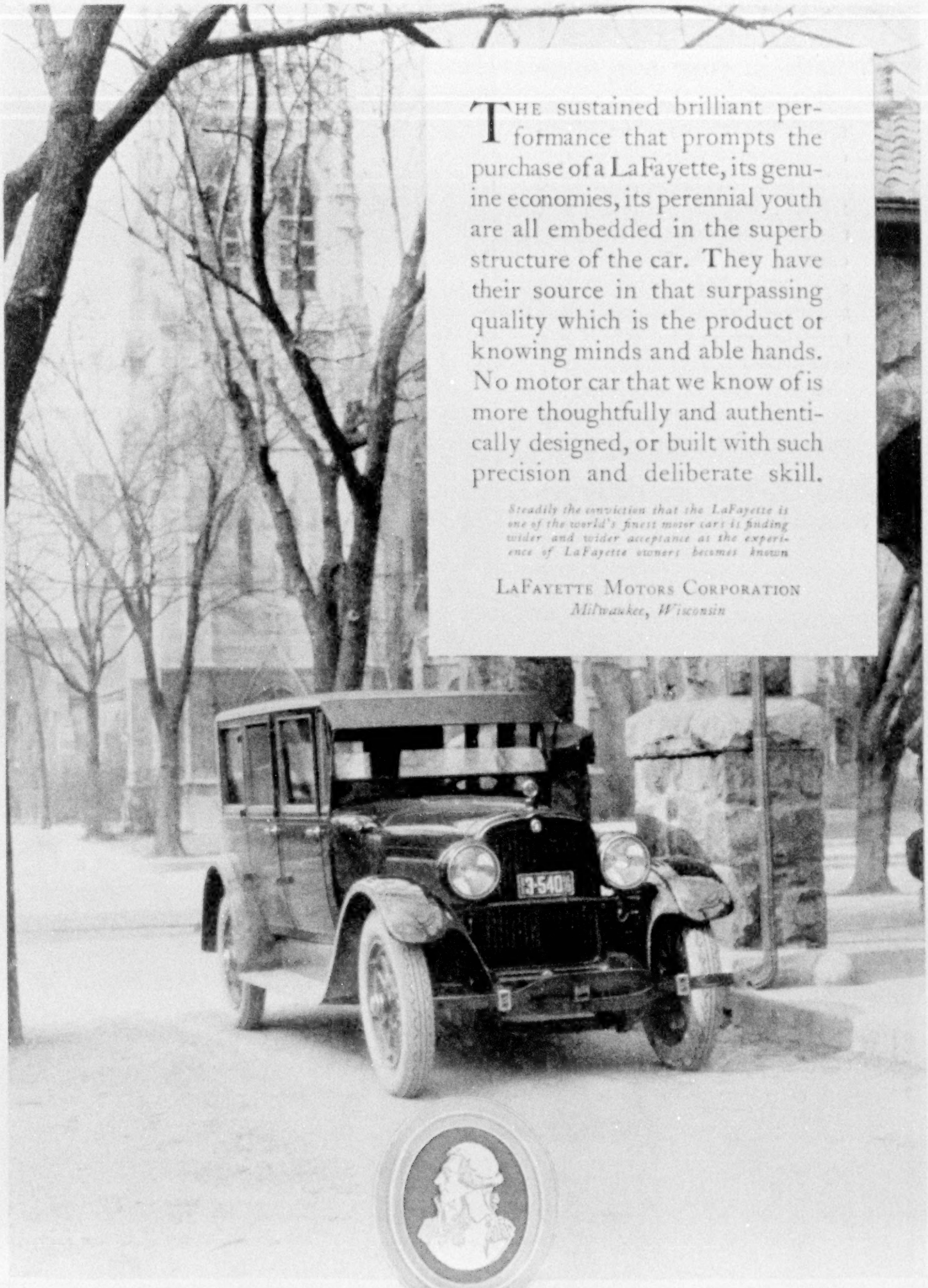
SILK
In covering on receiver and extension cords.

IRON
Magnet structure. Terminal and base plate, clamp and screws.

COPPER
Coil windings. (As brass) receiver terminals, screws, handle.

RUBBER
Receiver case; diaphragm cap.

WOOL
Felt pad at base of telephone.



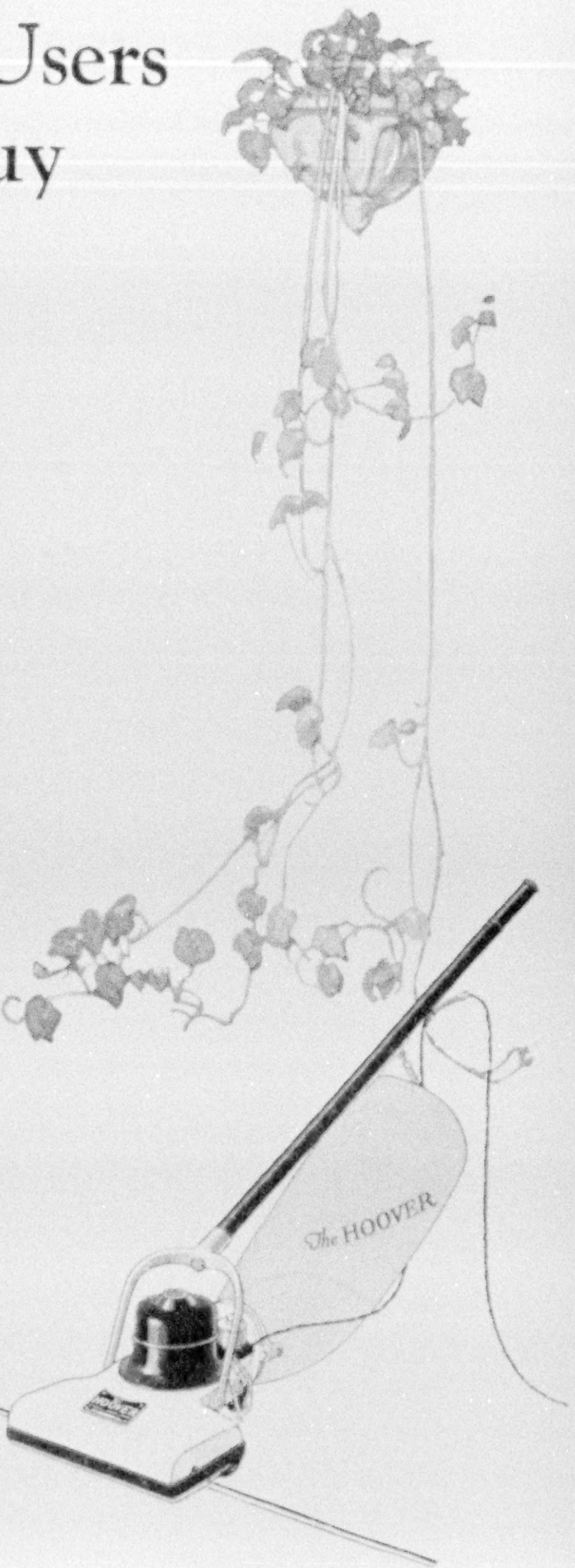
THE sustained brilliant performance that prompts the purchase of a LaFayette, its genuine economies, its perennial youth are all embedded in the superb structure of the car. They have their source in that surpassing quality which is the product of knowing minds and able hands. No motor car that we know of is more thoughtfully and authentically designed, or built with such precision and deliberate skill.

Steadily the conviction that the LaFayette is one of the world's finest motor cars is finding wider and wider acceptance as the experience of LaFayette owners becomes known

LAFAYETTE MOTORS CORPORATION
Milwaukee, Wisconsin

LAFAYETTE

Talk to Hoover Users Before You Buy



Although there is an electric cleaner in only one out of every three wired homes—and despite the fact that most of these cleaners are comparatively new—*already from 30% to 40% of our sales are made to owners of other machines!*

The conclusion is obvious. And, judging by what we hear from Hoover users, the percentage will grow.

As one woman aptly puts it, "Some of my friends liked my Hoover so well they sold their other cleaners and bought Hoovers. Others are sorry they didn't know The Hoover before buying. Many people are satisfied with their cleaners until they see The Hoover work."

Satisfied users* of The Hoover, more than any other factor, have made it the largest selling electric cleaner; be guided by this in your choice.

On the divided payment plan, $5 to $7 a month soon pays for a Hoover. Authorized Dealers will gladly demonstrate.

THE HOOVER COMPANY
North Canton, Ohio
The oldest and largest makers of electric cleaners
The Hoover is also made in Canada, at Hamilton, Ontario

**We have, in our files alone, nearly sixty thousand unsolicited letters of endorsement from enthusiastic Hoover users*

The HOOVER

It BEATS ... as it Sweeps as it Cleans

PRESS OF JUDD & DETWEILER, INC.
WASHINGTON, D. C.

A well-balanced food

THE most important period in a child's life is the early years when tissue and bones are being formed—and it is then that a mother should be most careful of the *kind* of food she serves her little ones.

A well-balanced diet must provide proteins, carbohydrates and mineral elements to maintain life and promote growth.

Grape-Nuts with milk or cream is a *well-balanced food* which supplies all the elements for perfect nutrition—vitamins, mineral elements, and other rich nutriment of wheat and malted barley. The long baking process makes Grape-Nuts easy to digest.

Crisp and delicious, Grape-Nuts is usually served as a cereal food; but it may be used in many different ways. It greatly improves the flavor and nutritive qualities of puddings, cakes, macaroons, fudge, ice cream and many other dainties.

"There's a Reason" for **Grape-Nuts**

Sold by grocers everwhere!

Made by Postum Cereal Company, Inc., Battle Creek, Michigan